SANITARY SEWERAGE FACILITIES
STANDARD CONSTRUCTION SPECIFICATIONS
FOR
THE CITY OF JACKSON, MISSOURI

PART 1 - GENERAL CONDITIONS

Section A. PURPOSE AND APPLICATION.

These specifications apply to all sanitary sewerage facility construction projects intended to be dedicated to the City for future operation and maintenance. For City-contracted projects, the project specifications developed specifically for each given project (if any) shall take precedence over these standard specifications.

Section B. DEFINITIONS.

Acceptance of the Work: That action by which the City acknowledges that all provisions of the contract have been fully performed.

Award: Notice to the Contractor of acceptance of bid, subject to conditions of invitation for bids and applicable ordinances.

Backfill: The material used to fill an excavation.

Base: The foundation or substructure resting on the underlying earth and supporting a pavement or structure.

Bedding: The material on which the pipe or conduit is supported and protected.

Bidder: The person or legal entity that submits an offer in accordance with the invitation for bids.

Cash Contract: A contract providing for payment in money.

Channel: A natural or artificial water course.

City: City of Jackson, Missouri

Concrete: A proportioned uniform mixture of graded fine and coarse aggregates and cementing material. The cementing material shall be Portland Cement and water for cement concrete, and bituminous cements for asphaltic concrete.

Contract: The agreement by which the successful bidder obligates the bidder to do the work in accordance with the invitation for bids.

Contract Bond: A performance bond for the full amount of the contract in the form provided by the City as directed by ordinance, and secured by a corporation engaged in the bonding business, duly licensed to do business in Missouri, and approved by the City.

Contractor: The person or legal entity that performs the work under the terms of the contract documents.

Culvert: A closed conduit for the free passage of surface drainage water under a roadway, railroad, or other embankment.

Developer: The person or legal entity responsible for the funding and construction of a project that will require sewer service.

Director: The Public Works Director of the City of Jackson or his properly authorized agents (such as the City Engineer or consultants employed by the City).

Easement: The right of the City to use land of another for sewer and drainage and construction purposes. Easements for construction and subsequent operation of sanitary or combined sewers shall be a minimum width of 15 ft.

Engineer: A person or firm licensed by the State of Missouri as a Professional Engineer.

Force Main: A pressurized sewer carrying wastewater.

Grout: A mortar of semi-fluid consistency.

Hazardous Waste: This term shall have the meaning prescribed in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903), as amended from time to time. Wastewater is not a “Hazardous Waste”.

House Connection: The point of connection between the house lateral and public sewer.

House Lateral: Private sewer from building drain(s) to public sewer.

Industrial Wastewater: The water-borne wastes from industrial operations, including contaminated cooling water, as distinct from sanitary (domestic wastewater).

Mortar: A proportioned uniform mixture of graded fine aggregate, cement and water.

Neat Cement: A uniform mixture of cement and water.

Private Sewer: A sewer not accepted for public use or maintenance, as determined by the City.

Project Plans and Specifications: The plans, profiles, cross-sections, drawings, and project specifications, or reproductions thereof, which are approved by the City and which show and describe the details of the work to be done.

Proposal: An offer to do the work in accordance with the invitation for bids.

Proposal Guaranty: The bid security of a certified check or cashier's check or a bid bond security by a duly licensed surety company in an amount as set forth in the invitation to bidders, to become the property of the City if the offer of the bidder is accepted by the City and the bidder fails or refuses to enter into a contract pursuant to bidder’s offer.

Public Right-of-Way: The land used by a public utility, agency, or municipality.

Public Sewer: A sewer which has been accepted for public use or maintenance, as determined by the City.

Roadway: That portion of a highway, street or road which is used for vehicular traffic.

Sanitary Sewer: A sewer which carries wastewater.

Sanitary Wastewater: Water-borne wastes emanating from the sanitary conveyances of residential or non-residential properties, as distinct from industrial (process) wastewater.

Sewage: See "Wastewater".

Sewer: A pipe or closed conduit designed for carrying wastewater.

Specifications: The particular requirements of the work to be done.

Standard Details of Sewer Construction: Plans of structures or devices or of construction details commonly used on City work and referred to on the plans or in the specifications.

Stank: A section of earth left in place above a short tunneled section between sections of open trench in a line of a trenching operation.

Stormwater Sewer: A sewer which carries surface runoff and subsurface waters.

Subcontractor: One who has, with City consent, entered into a contract to perform part of the work with the entity that has already contracted with the City for its performance.

Subgrade: The surface of the supporting earth or rock upon which a foundation base, pavement, walk, bedding, conduit, or a structure is to be placed.

Surety: A corporation acceptable to the City, that is duly authorized under Missouri laws to assume the responsibility of assuring the bonds of the Contractor to the City.

Swale: A broad, shallow water course.

Utilities: Public service facilities for supplying gas, electricity, water, power, steam, telephone and telegraph communication, railway transportation, and the like. Sewers are not considered utilities for purposes of this specification.

Wastewater: The water-borne wastes of a community, either sanitary or industrial (as defined herein), together with such groundwater or surface water that cannot reasonably be prevented from entering the sewer system.

Work: The construction of the sewerage facilities contracted for completion.

Work Day: All calendar days except weekends and City holidays.

Section C. SCOPE OF WORK.

1. Meaning of Plans and Specifications: All work contemplated and described in these specifications shall be done in accordance with the detailed drawings and all directives which will be given from time to time during the progress of the work. The drawings and specifications form a part of the contract. If any discrepancy appears between any of the drawings and the specifications, or between any of the drawings, such discrepancy shall be interpreted and adjusted in writing by the Director whose decision shall be final. Any doubts as to the meaning of these specifications or any ambiguity in wording shall be explained and interpreted by the Director who shall have the right to correct any error or omission in them when such correction is, in his opinion, necessary for the proper

fulfillment of their intention. The City shall not be liable for any increase in price as a result of such interpretation. When reference is made to a particular specification, it shall be interpreted to be the latest current revision thereof.

2. Decision of Director Conclusive: To prevent all disputes and litigation, the Director shall in all cases decide all questions which may arise relative to interpretations of the plans and specifications, to the acceptability of work done by the Contractor, and to the estimates. The Director's decisions shall be final and conclusive.

3. Or Equal Clause: Whenever in these specifications or in any of the contract documents, any articles, appliance, device, or material is designated by a trade name and such words are not followed by the condition "or equal", it shall be deemed that the words "or equal" do follow such designation, unless the text clearly requires a contrary interpretation. Any article or material equaling the standards fixed may be used in place of that specifically mentioned by the specifications, provided the material proposed is first submitted to and approved by the Director.

4. Ambiguity of Plans or Specifications: If the Contractor does not clearly understand the plans and specifications or is not sure of their meaning, the Contractor shall obtain the Director's written explanation and interpretation, since the Contractor will be held rigidly to the interpretation of the Director.

5. Rights-of-Way and Easements: All sewers and appurtenances shall be constructed in easements and public rights-of-way.

6. Additions or Deletions of Work: The City shall have the right to make changes in the plans or specifications or the character of the work or to increase or decrease the quantity of work provided the total value of such changes, together with all previous changes, is not in excess of 25% of the original total monetary amount of the contract. Should it become necessary or in the best interests of the City to make increases or decreases exceeding this limitation, they will be covered by a supplemental written agreement entered into by the Contractor and the City.

7. Emergency Change Orders: Should a change be required and it is not feasible to delay construction of that portion of the improvement affected by the change until such time as a regular change order can be issued, and the estimated increase or decrease in contract cost does not exceed $ 1,000, a written emergency change order may be issued in the field by the Director's representative, and the Contractor shall then proceed with the work without delay. Such emergency change orders will be confirmed by regular change orders at a later date.

8. Changes Requested by the Contractor: The Director may, at the Contractor's request, authorize in writing changes in the plans or specifications to facilitate or expedite the work of the Contractor, provided such changes are not detrimental to the work or to the best interests of the City. Requests for such changes shall be submitted in writing to the Director. Such changes as are authorized under this provision shall be made without additional cost to the City, and the City reserves the right to receive an equitable adjustment in the contract price or contract time as a consideration for authorizing any such change.

9. Changed or Unforeseen Conditions: During the progress of the work, if the Contractor should encounter conditions materially different from those shown on the plans or indicated in the Project Specifications, or unknown conditions of a nature differing

materially from those ordinarily encountered and generally recognized as being inherent in work of the character being performed, the Contractor shall, before proceeding further with work affecting or affected by such conditions, immediately notify the Director who which will promptly make an investigation. If conditions do materially differ and the Contractor could not reasonably have been expected to ascertain in advance the true nature of the existing conditions, a change order will be issued to provide for any increase or decrease in cost and difference in contract time resulting from any such condition.

10. Submittal of Claims: Any and all claims for additional compensation or completion time extension must be submitted to the City in writing within 30 days of the occurrence of the event from which the claim allegedly arises, or no consideration will be given to such claim.

Section D. CONTROL OF WORK.

1. Subcontract: The Contractor may not subcontract more than 50% of the work unless approved by the Director. Requests for permission to subcontract any portion shall be submitted to the Director in writing. Such requests shall state the type of work to be subcontracted and the names of the proposed subcontractors. No work shall be subcontracted without the written consent of the Director and approval of the subcontracting parties by the City. Such consent to subcontract shall not be construed to relieve the Contractor of any of his responsibility under the contract.

2. Contractor's Responsibility for Work as a Whole: The Contractor shall be responsible for the entire work until its final acceptance by the City. The Contractor shall not be released from any responsibility for any part of the work until the entire work embraced in his contract is finally accepted.

3. Authority of the City’s Representative: The Director, who is authorized by the City Council, may act in the City's behalf in all matters affecting the work covered by these specifications. Within the scope of the contract, the Director and his inspection representatives are authorized to enforce compliance with plans and specifications, to determine the acceptability of materials and workmanship, and to prepare and process progress and final payment estimates. In the event of dispute between the Contractor and the inspection representative, the latter is authorized to reject materials or to suspend work until questions at issue can be referred to and decided by the Director.

4. Contractor to Stake Out Work: The Contractor shall stake out the work and furnish all survey party personnel, instruments, labor, and stakes required. The Contractor shall also furnish all means of alignment and grade control and the labor for setting them. The Contractor shall be careful to preserve stakes and surveyor’s marks from damage or dislocation during construction activities, and shall replace all stakes and survey marks destroyed, lost, or displaced because of his negligence.

5. Approved Plans: No work shall begin until the plans have been approved by the City.

6. Supplemental Drawings:

    a. The Contractor shall furnish shop drawings, having been approved by the Engineer, for all steel reinforcement in reinforced concrete structures, and for all work as required by the plans, the project specifications, or these standard specifications. Shop drawings shall be fully detailed fabrication plans and shall

include any erection plans needed to determine the location of individual members in the proposed structure.

b. The Contractor shall submit three prints of each drawing to the Director two weeks prior to the date on which such work shall begin. After being checked, one print of the drawing will be returned to the Contractor who shall correct the original drawing as indicated on the print and furnish to the Director a printable transparency of the corrected drawing. This transparency, if found correct, will be approved and retained by the Director. Prints from the approved transparency will be furnished to the Contractor by the City without cost to the Contractor. Work to which any of these drawings is applicable shall not be performed prior to the approval of such drawings by the City. No change shall be made on any supplemental drawing after it has been approved by the City, except on further approval of the City.

c. If a drawing, submitted by the Contractor as hereinbefore required, includes any modifications or changes of any specific requirements of the contract plans or specifications, the Contractor shall make a clearly legible note of such changes on the drawing. Such drawings, when approved by the City, shall then supersede the requirements of the contract plans and specifications in these particulars. If a modification causes a change in contract cost or other change of a substantial nature, a change order will be issued.

d. The City's approval of drawings submitted by the Contractor will indicate approval only insofar as the finished work may be affected, or approval of the proposed methods of construction. Such approval will not indicate that these drawings have been completely checked for accuracy of dimensions and details and conformity with plans and specifications. The Contractor shall be responsible for any field measurements required, for accuracy of dimensions and of details, and for conformity with plans and specifications. Full compensation for furnishing all drawings required to be furnished by the Contractor shall be considered as included in the prices bid.

7. Methods and Appliances: The methods, labor, equipment, and other facilities used by the Contractor must be such as shall assure performance of the work in accordance with the plans and specifications, and within the time specified for completion.
8. Inspection of the Work:

a. The City and its authorized representatives shall be given free access to the work, storage sites, and all material-producing facilities. Every reasonable aid shall be provided for ascertaining that the materials and workmanship are in accordance with the plans and specifications. The inspection of all work, unless otherwise specified, will be under the jurisdiction of the Director.

b. All work shall be done only in the presence of a City inspector unless otherwise specifically authorized; and any work that is performed during the absence of said inspector without such permission having been granted, will be subject to rejection.

c. Any work not constructed in accordance with plans and specifications, whether or not constructed in the presence of a City inspector, shall be subject to rejection at any time prior to formal acceptance.

d. At the beginning of the work, or on resumption thereof after temporary suspension for any reason for more than one workday, the Contractor shall make application for an inspector prior to noon of the working day before inspection service is required on the work.

e. Whenever the Contractor is permitted or directed to perform night work or to vary the period during which work is carried on by day, the Contractor shall give reasonably adequate notice to the City inspector so that inspection may be provided.

f. When the work has been completed and the job site has been restored as required, a final inspection of the work will be made under the supervision of the Director.

9. Rejected or Unauthorized Work:

a. Work which has been rejected shall be repaired, or removed and replaced by the Contractor as ordered by the City and without extra compensation for such corrective work. On failure of the Contractor to comply with such order, the City may cause such defective or rejected work to be removed and replaced, and shall deduct the cost of such repair or removal and replacement from any moneys due or to become due to the Contractor. Furthermore, the Contractor may be removed from the City's list of eligible bidders for future City projects.

b. Any work done beyond the lines and grades shown on the plans or established by the Director, and any extra or additional work done without prior written authority, will not be paid for. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to correct any defective work.

Section E. PROSECUTION, PROGRESS AND ACCEPTANCE OF THE WORK.

1. Time of Commencement: The work embraced in these specifications shall start within ten calendar days after the date of written notice to commence work, and shall be carried on regularly thereafter with such force and equipment and in such manner as to insure its completion within the contract time. If the Contractor does not comply with the foregoing without a written, City-approved explanation, he may be removed from the list of eligible bidders for future City projects.

2. Order of Work: The work to be done under these specifications shall be begun and carried on at such locations and in such order of precedence as the Director may require, and shall be completed on or before such date as is specified in the contract. The Contractor shall employ such means and methods in doing his work so as not to interrupt, delay, damage or interfere with the work of any other contractor. All sewer construction shall begin at the most downstream end of the project and proceed upstream, unless otherwise approved in writing in advance by the City.

3. Work to Stop During Unsuitable Weather:

a. During unsuitable weather adverse to the prosecution and welfare of the work, all work must stop when so ordered by the Director and all work must be protected from possible injury.

b. No charge shall be made by the Contractor for delay by extreme or unusual weather, but, an extension of completion time shall be given to the Contractor by the City equal to the time of delay as determined by the Director, provided the request is made in writing by the Contractor of such an extension in time promptly on termination of such delay, and the Director has approved such request in writing.

4. City's Liability for Delays: Delays caused by the City, and claimed in writing by the Contractor, will be considered for reimbursement and/or an extension of completion time. Consideration will only be given to the actual time that no progress was made.

5. Contractor's Delays or Abandonment:

   a. If the Contractor should unnecessarily delay the work, the Director shall give notice in writing to the Contractor and to his surety that the work is being unnecessarily delayed; that all measures shall be taken to insure the completion of the work within the required time limit; and that, if adequate effective measures are not taken within five calendar days after the date of delivery by registered mail of such notice, to increase the rate of doing acceptable work so that the work may be completed within the contract time limit, the contract may be terminated or cancelled.

   b. If the Contractor should abandon the work to be done under this contract, or should neglect or refuse to comply with the instructions of the Director relative to delay or abandonment, or should fail in any manner to comply with the specifications or stipulations herein contained, the City will have the right to annul and cancel this contract on ten days prior notice by registered mail to the Contractor and to his surety, and to complete the contract at the expense of the Contractor and his surety. In such event, the City will have the right to use any and all tools, material and equipment belonging to the Contractor for the completion of the work.

6. Contractor's Liability for Exceeding the Contract Period:

   a. The work embraced in the agreement shall be carried on regularly and uninterruptedly at a sufficient rate to secure its full completion within the time limit specified in the contract. Normally expected delays on account of rain or unfavorable weather shall be taken into account in planning the work.

   b. The rate of progress and the time of completion are essential conditions of the contract. If the Contractor fails to complete work within the time contracted, payment shall be made to the City for liquidated damages as provided by the project specifications. Such payments to the City are regarded by both parties to the contract as liquidated damages for the actual costs to the City of delay in completion of the work and shall not be considered as a penalty. Saturdays, Sundays, and legal holidays are excluded as working days unless work is one under special permission or emergency requiring the presence of the City.

7. City's Right to Use Work Prior to Acceptance:

   a. City shall have the right to use the whole or any part of the construction work which is in usable condition prior to the acceptance of all of the work, provided

such parts have received prior field approval. Use of this work shall not be considered as acceptance either in whole or in part.

b. Whenever a property owner desires to connect to a sewer before acceptance of all the work, the Director may approve the application for a connection permit (only with the written consent of the Contractor).

8. Contractor's Relief from Maintenance and Responsibility. On the request of the Contractor and with the approval of the Director, or on the order of the Director, the Contractor will be relieved of the duty of maintaining and protecting certain portions of contract improvements which are ready to be placed in service and which have been completed in accordance with the plans and specifications, including cleanup. In addition, such action by the Director will relieve the Contractor of responsibility for injury or damage to said completed portions of the improvements resulting from use or from other cause, excepting injury or damage resulting from the Contractor's own operations or from his negligence. The Contractor will not be required again to clean up such portions of the improvement prior to acceptance except for such items as result from his operations or negligence. Warranties on mechanical equipment shall begin on the day of acceptance by the City of such mechanical equipment.

9. Field Approval of the Work:

a. Field approval shall be limited to acknowledgment by the Director that the work has been performed in accordance with the plans and specifications.

b. On completion of the work and after final clean-up, the Contractor shall request the Director to make a final inspection of the work. The Director will commence with such final inspection within two working days, if practicable, and proceed diligently with such inspection. If the work has been completed in accordance with the plans and specifications, the Director will proceed with preparing the final payment and recommendations for City acceptance. However, the Contractor shall be responsible for the work except as otherwise provided, until such acceptance.

10. Acceptance of the Work: Acceptance indicates that all due performance of the contract has been completed except for the requirements of certification of payment for labor and materials and for final payment of any amounts due to the Contractor from the City.

11. Time of Completion:

a. The Contractor shall complete the work within the time specified in the contract, modified by such extensions during the contract period as are granted in writing by the Director.

b. In connection with any requests by the Contractor for extensions of time, the Director will give due consideration to delays in the commencement, prosecution, or completion of the work due to causes beyond the control and not the fault or negligence of the Contractor, including, but not restricted to, failure of the City to provide rights-of-way, acts of God or of the public enemy, acts of the Federal Government or any State or political subdivisions thereof, acts of another Contractor in the performance of a contract with the City, fires, floods, explosions, earthquakes or other catastrophes, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays in

the delivery of material when the City has specified the procurement of such material from a particular source; provided that the Contractor shall, within ten days from the beginning of any such delay, notify the City in writing of the causes of the delay.

c. In those instances or circumstances as set forth in the preceding subparagraphs, the Director will determine the extent of the delay and grant a commensurate extension of time. An extension of time granted by the City shall not release the sureties on the Contractor's bonds. Such bonds shall remain in full force and effect according to their terms.

Section F. RESPONSIBILITIES OF THE CONTRACTOR.

1. Observance of Laws and Regulations:

a. The Contractor shall keep fully informed of all federal, state and municipal laws, ordinances and regulations which may affect the conduct of the work, the safety of the public and those engaged or employed, and the materials used; and of all orders and decrees of bodies having jurisdiction or authority over the work. The Contractor shall observe and comply therewith, and shall cause his agents and employees to observe and comply therewith. The Contractor shall protect and indemnify the City and all its officers, agents, and employees against any claim or liability arising from or based on the violation thereof by himself or his employees.

b. Prevailing rates of pay shall be paid to skilled and unskilled labor employees on the contract work.

c. No discrimination shall occur in the selection or employment of labor on account of creed, race, color, or sex.

d. When plan, plats, detailed drawings or specifications for any part of the work are required to be submitted to the City, they shall be signed, sealed and stamped in accordance with the provisions of the latest revision of the act providing for the registration of architects and professional engineers in the State of Missouri.

e. The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work and submit copies to the City prior to the first project payment. The Contractor shall pay all taxes lawfully imposed by any taxing authority on the sale, purchase, and use of any materials or equipment in the work.

f. The Contractor shall keep the City free and harmless from payment of any and all damages, costs, expenses, royalties, patent fees, lawyers' fees, or sums of money whatsoever by reason of any patent or patented device, article, system, or arrangement that may be used by the Contractor in the execution of the work.

g. The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of the public health authorities and ordinances, regulations, and requirements of bodies having jurisdiction. The Contractor shall commit no public or private nuisance.

2. Superintendence: The Contractor, or his authorized representative in charge of the work, shall be present at the site of the work at all times while work is in progress. Any order or communication given to this authorized representative shall be considered to have been delivered to the Contractor. Where the Contractor is comprised of two or more persons, partnerships, or corporations functioning on a joint venture basis, such Contractor shall designate in writing to the City the name of the authorized representative in charge of the work.

3. Labor Competency: The Contractor shall retain in his employment only competent superintendents, foremen, mechanics, and laborers. Any person employed on the work who, in the opinion of the Director, is intemperate, incompetent, troublesome, or otherwise undesirable, or who fails or refuses to perform the work in the manner specified herein, shall be discharged immediately from employment on the work. Such person shall not again be employed on the work without the consent of the Director.

4. Project Site Maintenance:

   a. The Contractor shall be fully responsible for maintaining completed work in an acceptable condition and protecting the completed work until relieved of such responsibility. During construction the Contractor shall keep the work site free and clean from all rubbish and debris. The Contractor shall also keep his haul routes outside the work site free and clean from all rubbish and debris resulting from his operations.

   b. On completion of the work and before acceptance and final payment are made, the Contractor shall remove all surplus and discarded material, rubbish, equipment, debris, and temporary structures from the site, and restore the working site as required. The sewers and appurtenant structures shall be clean, free from debris or deposits, and ready for use as required by the plans and specifications. All costs of such work shall be considered to be completely paid for under the various contract pay items.

5. Public Convenience and Safety: The Contractor shall observe and adhere to the safety requirements of all federal, state and local authorities having jurisdiction. During the progress of the work, the Contractor shall maintain suitable barricades and warning lights or employ such other devices and measures for the safety of the public as required by law and shall take all necessary precautions to prevent accidents. The Contractor shall make suitable and adequate provisions for the convenience and safety of the public and of the residents along the route of construction. The Contractor shall give adequate notice in writing to all owners or occupants of property, buildings, structures, or utilities which may be affected by this work and which may require protection or adjustment. The Contractor shall not hinder their protective measures, but shall exercise due care to protect all property. The Contractor shall not obstruct access to fire hydrants and service valves, nor to U. S. mail boxes. The Contractor shall repair and restore without delay to service any utility service facilities damaged by his operations, and shall cooperate with utility companies in the restoration of their service.

6. Indemnification: The Contractor and any subcontractor shall defend (and have the right to select counsel for the City), indemnify and save harmless the City, its Council and employees, from and against any and all loss, damages, liability, costs and expenses (including but not limited to attorneys' fees of counsel for the City that the Contractor authorizes) arising out of any claim, suit or action against the City for or on account of any personal injuries, including death, or property damages sustained or claimed to be

sustained by any person or persons arising out of or resulting from performance of the work, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor or any subcontractor, their agents or employees.

7. Insurance:

   a. The Contractor shall carry adequate public liability and property damage insurance for the joint and several benefit of the Contractor and the City with a company licensed to do business in the State of Missouri and satisfactory to the City. The amounts of coverage required for public liability or property damage shall not be construed to limit the liability of the Contractor in protecting the City from damage or injury claims. If the Director determines that unusual or special risks revealed by the work so require, the City shall have the right to require the Contractor to increase any or all such insurance policy limits while the contract work is in progress, and in such amounts as the Director may determine to be adequate, and without thereby limiting the liability of the Contractor in protecting the City from damage or injury claims.

   b. As partial security for the defense of claims and the payments required under such indemnity, the Contractor and any subcontractor shall furnish at his cost an Owner's Protective Insurance Policy satisfactory to the City and naming the City as insured for amounts not less than the Contractor's public liability and property damage insurance covering the work.

   c. The coverage shall insure the City and its officers and employees, while acting within the scope of their duties, against all claims arising out of or in connection with the work to be performed. The cost of the insurance shall be included in the prices bid for the various items of work and no additional payment will be made thereof.

8. Public Officials Not Personally Liable: There shall be no personal liability on the part of public officials of the City or its agents or employees for any act performed in the discharge of any duty imposed, or the exercise of any power or authority conferred on them by or within the scope of the contract. It is understood that in all such matters such persons act solely as agents and representatives of the City.

9. Use of Explosives: The responsibility of the Contractor with respect to the use of explosives includes compliance with all laws, rules and regulations of federal, state and local authorities and the insurer governing the keeping, storage, use, manufacture, sale, handling, transportation, or other disposition of explosives shall be conducted with every precaution by a few trained, reliable men under satisfactory, experienced supervision. Blasts shall not be fired until all persons in the vicinity have had ample notice and have reached positions out of danger. The Contractor shall be responsible for any and all damage resulting from the use of explosives, and the Contractor shall notify the Director in advance when charges are to be set off. The Contractor agrees to save the City, its officers and employees harmless from any claim growing out of the use of such explosives.

10. Disposition of Materials: When materials are to be disposed of outside the right-of-way, the Contractor shall obtain permission beforehand in writing from the property owner on whose property the disposal is to be made and shall file a copy of such permission with the City. Unless otherwise provided in the Project Plans and Specifications, the

Contractor shall make his own arrangements for disposing of such materials outside the right-of-way.

11. Cooperation Between the Contractor, Utility Owners, and Other Contractors:

    a. Ordinarily, utility owners and public agencies responsible for facilities located within the right-of-way will be expected to complete any installation, relocation, repair, or replacement prior to the commencement of work by the Contractor. However, when this is not feasible or practicable, or the need for such work was not foreseen, such utility owners or public agencies shall have the right to enter upon the right-of-way and upon any structure therein for the purpose of making new installations, changes, or repairs, and the Contractor shall so conduct his operations as to provide the time needed for such work to be accomplished during the progress of the improvement.

    b. Any difference or conflict which may arise between the Contractor and other contractors who may be performing work in behalf of the City, or between the Contractor and workmen of the City in regard to their work shall be adjusted as determined by the Director. If the work of the Contractor is delayed because of any acts or omissions of any other Contractor of the City, the Contractor shall on that account have no claim against the City other than for an extension of time.

12. Traffic: The Contractor shall notify the proper authorities at least two working days in advance of starting work on a traveled street. The Contractor shall comply with the directives of such authorities regarding traffic control.

Section G. MEASUREMENT AND PAYMENT.

1. Measurement of Quantities:

    a. All materials and items to be paid for on the basis of measurement shall be measured and determined by the City's Inspector in accordance with the plans and specifications, or as authorized by the Director.

    b. In accordance with Section 144.030 of the Missouri State Statutes, the City will not pay Missouri State Sales Tax on material, machinery, equipment, appliances, and devices used solely for the purpose of preventing, abating, or monitoring water pollution.

    c. Measurements shall be in accordance with United State Standard Measures.

    d. Work or materials involved in lump sum payments will not be measured, but will be paid for in accordance with the details described in the Project Plans and Specifications.

    e. Materials normally will be paid for on a volume, area, or other unit of measure basis. Factors for conversion from weight measurement to volume measurement will be determined by the City's Inspector and shall be agreed to by the Contractor before the weight basis of measurement of pay quantities will be used.

f. Material paid for by the ton shall be weighed on a certified public scale, and a certified copy of the weight ticket shall be furnished to the City's Inspector in evidence of the delivered weight of the material.

g. Trucks used to haul material being paid for by weight shall be weighed empty at such times as the City's Inspector directs. Each truck shall bear a plainly legible identification mark.

h. Full compensation for all expense involved in conforming to the above requirements for measuring and weighing materials shall be considered as included in the unit price paid for the material being measured or weighed, and no additional allowance will be made therefore.

2. Limitation on Pay Quantities: Quantities of materials wasted or disposed of in a manner not called for under the contract, including rejected loads of material not unloaded from vehicles, material rejected after it has been placed, material placed outside the pay lines, and material remaining on hand after completion of the work, will not be paid for and will not be included in the final pay quantities. No compensation will be allowed for disposing of rejected or excess material.

3. Scope of Payment: The Contractor shall accept the compensation as herein provided in full payment for furnishing all materials, labor, services, supervision, tools and equipment necessary to the complete work (including overhead and profit); and for performing all work contemplated and embraced under the contract; and for loss or damage arising from the nature of the work or from the action of the elements, except as hereinbefore provided; or from any unforeseen difficulties which may be encountered during the prosecution of the work until the acceptance by the Director; and for all risks of every description connected with the prosecution of the work; and for all expenses incurred in consequence of the suspension of discontinuance of the work as herein specified; and for completing the work according to the plans and specifications. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to replace or to make good any defective work or material.

4. Payment for Changes and Extra Work:

a. When extra work for which no provision has been made under the contract is ordered by the City, payment will be made in accordance with bid prices for the given items of work. In the absence of a bid price for a given item of work not provided for nor fairly included in bid prices for other items of work, a written agreement may be made between the City and the Contractor to be included in the written order for such extra work. If the City and the Contractor are unable to reach an agreement, the Director may order the Contractor to proceed with the work by force account in accordance with the following sections.

b. Whenever the Contractor and the City are unable to agree on prices for the extra work, and the City orders the Contractor to proceed with the work by force account, the work will be paid for in the manner hereinafter described and the compensation thus provided shall constitute full payment for said work. Payment will be determined as follows:

i. For all materials purchased by the Contractor and used in this specific work, the Contractor will be paid the actual cost of such materials and freight and delivery charges as shown by original receipted bills; to which

will be added an amount equal to 15% of the sum thereof. The total amount so paid will be full compensation for all costs of materials, whether direct or indirect. If necessary to facilitate the progress of the work, the City reserves the right to furnish and deliver the materials to the Contractor at the site. No percentage will be paid to the Contractor on any material furnished by the City.

ii. The Contractor will be paid the cost of wages for all labor required in the specific operation plus the actual cost chargeable to the force account work for workmen's compensation insurance, social security taxes, unemployment compensation insurance, and such additional amounts as are paid by the Contractor by reason of an employment contract generally applicable to his employees, to which total sum will be added to an amount equal to 35% of the wages and other costs listed above. To the cost of any work subcontracted by the contractor will be added an amount not to exceed 10% of the cost as submitted by the subcontractor.

iii. Wage rates used in determining the amount of the payment will be the actual wage rates paid by the Contractor, except that no rate used shall exceed the rate of comparable labor currently employed on the project.

iv. Payment will be made for the services of foremen in direct charge of the specific operation. Payment for the services of superintendents, timekeepers or other overhead personnel will not be made nor will payment for the services of watchmen be made unless required specifically for the force account work. The actual function performed by an employee rather than his payroll title will be the criterion used in determining the eligibility of an employee's services for payment under this provision.

c. The types and amount of equipment and machinery used by the Contractor in carrying out his work under the force account order shall be in keeping with normal practice for work of a similar nature, except that the City may, at its discretion, limit by specific instruction the types and amounts of equipment to be used. For the cost of such equipment, the Contractor will be paid reasonable rental prices to which shall be added the cost of fuel and lubricant to which no percentages will be added.

d. In computing the hourly rental of such equipment, less than 30 minutes shall be considered one-half hour, except that the minimum rental time to be paid shall be one hour. Rental time will not be allowed while equipment is inoperative due to breakdowns. The rental time of equipment to be paid for shall be of the time the equipment is in operation on the force account work being performed, and in addition, shall include the time required to move the equipment to the work and return it to its original location. When approved in advance by the Director, towing or transporting costs will be allowed when the equipment is moved by means other than its own power. No payment will be allowed for the use of small tools and minor items of equipment which, as used herein, are defined as individual tools or pieces of equipment having a replacement value of $500.00 each or less. Equipment rental may be based on Rental Rate Blue Book monthly rates pro-rated to the applicable hour, day or week. In lieu thereof, equipment rental may be based on the Contractor's actual equipment costs as verified by a certified public accountant.

e. The Contractor will be reimbursed for all additional bond and insurance premiums which are required and expended because of the force account work. No percentage will be added to this reimbursement.

f. The Contractor and Inspector shall compare records of the work performed on a force account basis at the end of each day. These records shall be prepared in triplicate by the Contractor and shall be signed by both the Inspector and the Contractor's representative, one copy being retained by the Contractor and one copy forwarded to the City's Inspector.

g. In evidence of the costs of labor, equipment, and materials for which payment is to be made under the force account order, the Contractor shall provide a certified statement of wages actually paid together with copies of supporting payrolls, of equipment rental charges, and of bills for materials. On special tax bill projects, a percentage equivalent to the tax bill discount, verified by the Contractor, will be added to the force account payments.

h. Payment for force account work will be included in monthly progress payments. City emergency projects that are to be paid for entirely by the force account method will be constructed and paid for under provisions set forth in "The Method and Procedure of Payment for Major Force Account Work." The project will then be constructed and paid for in accordance to said directive, in lieu of this Section of the Standard Construction Specifications.

5. Materials and Labor Bills: Before final payment is made to the Contractor, the Contractor shall certify in writing to the City that all bills, for materials, services, labor and equipment have been paid, and shall submit waivers from subcontractors and suppliers for unpaid amounts due them.

6. Payment on Cash Contracts:

a. During the progress of the work, the Contractor shall submit within ten days after the first of each month an invoice for the estimated cost of the work satisfactorily completed to the first day of that month. It shall be in such form and detail as required by the Director, and shall be based on the City’s estimated quantity of completed work in place and the unit bid prices. The cost of critical materials and equipment received by the Contractor with approval of the Director, of materials procured in substantial quantities and major items of equipment received and scheduled to be incorporated in the construction within thirty days from the date of the invoice, and of all other materials and equipment actually incorporated in the construction shall be considered as work done or accomplished for the purpose of invoicing or making monthly payments. The Contractor is responsible for all equipment and materials so paid for in advance before their incorporation in the work. From the amount so determined shall be deducted five percent of such amount and all sums previously paid or properly retained under this contract, and the remainder certified for payment on account to the Contractor. If the Director finds that satisfactory progress is being made in the work, the Director may, at his discretion, reduce the amount to be retained to conform with the following schedule of retention rates:

Range of Contract	Retention Rate
For first $1,000,000 of Contract amount	5%
For all amounts in excess of $ 1,000,000	2 1/2%

b. The total amount retained equals the sum of the amounts retained within each range.

c. When all the work provided for under this contract is completed in conformance with the Project Plans and Specifications and the project has been accepted, a final cost estimate based on a final measurement survey shall be made. The remainder shall be certified as any appropriate charges, and deductions will be made and the amount due to the Contractor, and on approval by the Director and on certification by the Contractor that all bills for materials, services, labor, equipment, and other items due or chargeable under the contract have been paid or waivers obtained, payments shall be made to the Contractor who shall give a release from all claims arising from the contract.

PART 2 - MATERIALS OF CONSTRUCTION

Section A. INTRODUCTION.

1. This part sets forth requirements governing the quality of the various materials specified for use in the construction of sanitary sewerage facilities in the City of Jackson, Missouri.

2. Whenever in these specifications reference is made to the requirement of the ASTM (American Society for Testing and Materials), AWWA (American Water Works Association), ANSI (American National Standards Institute), AASHTO (American Association of State Highway and Transportation Officials), or other specified standard specifications, the current revision thereof shall be used.

Section B. CONTROL OF MATERIALS.

1. Approval: All materials shall be the best of their respective kinds, subject to sampling, testing, and approval or rejection by the City. Unless otherwise specified, all materials incorporated into the work shall be new and unused in previous construction. Used materials, in acceptable condition, may be used for trenching bracing, forms, falsework, and similar uses.

2. Sources of Supply: The Contractor shall furnish to the Director (prior to starting) work a complete list of the sources from which the Contractor proposed to obtain materials, and shall notify the Director prior to any change in the source of such materials.

3. Sampling, Inspection and Testing:

    a. All materials to be used in the work shall be sampled, inspected, and tested in accordance with current standard methods of testing of the ASTM, AWWA, ANSI, AASHTO, or other Specified Standard Specifications. The cost of all testing is the responsibility of the Contractor. The Contractor shall furnish the City with three copies of certified reports from a reputable testing laboratory showing the results of the test carried out on representative samples of materials delivered and to be used in this project. The Contractor shall notify the City in advance of any deliveries of the materials and shall make whatever provisions are necessary, including the furnishing of such labor as may be required to aid the Director in the examination, inspection, and culling of the materials on the site prior to installation in the work. All rejected materials shall be immediately and permanently removed from the site.

    b. The Contractor shall cooperate fully with all representatives of the City in the inspection of materials to be furnished for the purpose of verifying that they correspond strictly with the plans and specifications.

4. Materials and Equipment Not Locally Produced: When the Contractor intends to purchase materials or mechanical, electrical or manufactured equipment to be permanently installed in accordance with the plans and specifications from sources located more than 150 miles from the City, the City may require the Contractor to furnish certification by a testing laboratory approved by the City that the materials or such equipment meet all applicable specifications. The representative of the testing laboratory shall be governed in his judgment of the materials or equipment by the requirements of the specifications, and shall forward to the Director whatever reports are

required by the City. No such materials shall be shipped nor shall any processing, fabrication, or treatment of such materials be done without proper inspection by the approved agent. These materials shall be subject to reinspection at the job site.

5. Storage of Materials: The Contractor shall provide such storage facilities and exercise such measures as will insure the preservation of the specified quality and fitness of materials and equipment to be incorporated in the work.

6. Rejected Materials: Materials and equipment not conforming to the specifications, whether in place or not, may be rejected. Rejected materials shall be removed immediately and permanently from the site of the work, unless otherwise permitted by the Director. No rejected material, the defects of which have been subsequently corrected, shall be used unless approved in writing by the Director. On failure of the Contractor to remove and replace rejected material, the Director shall have authority to do so and to deduct the cost thereof from any moneys due or to become due to the Contractor. The payment of any estimate or of any retained percentage shall not relieve the Contractor of any obligation to replace and make good any rejected material.

Section C. CONCRETE.

1. Portland Cement: It shall conform to the requirements of Specifications for Portland Cement, ASTM C150. Type II cement shall be used, unless otherwise specified.

2. Air-Entraining Admixtures for Concrete: They shall conform to the requirements of the Specifications for Air-Entraining Admixtures for Concrete, ASTM C260.

3. Aggregates for Concrete:

   a. Aggregate shall conform to the requirements of Specifications for Concrete Aggregates, ASTM C33, except as further specified herein.

   b. Natural sand shall consist of clean, hard, durable, uncoated grains. Mississippi and Missouri River sands or other sands containing lignite are not acceptable for exposed architectural concrete. Gravel shall be washed, hard, strong, durable pieces free from thin, porous, elongated or laminated particles. Crushed limestone for coarse aggregate shall consist of uncoated particles of sound, durable rock of uniform quality, without an excess of flat, elongated or laminated pieces. No surface, yellow or soft stone shall be permitted. The specific gravity of the stone shall be not less than 2.56.

4. Water: When used with cement in mortar or concrete or for curing of concrete or for testing of structures for water-tightness the water shall be potable.

5. Metal Reinforcement in Concrete:

   a. Reinforcing bars shall conform to the requirements of the Specifications for Steel Bars for Concrete Reinforcement, ASTM A615, A616, or A617.

   b. Welded wire fabric or cold-drawn wire for concrete reinforcement shall conform to the requirements of the Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A82, or the Specifications for Welded Steel Wire Fabric for Concrete Reinforcement, ASTM Al 85.

c. Certified mill tests shall be furnished for all reinforcing steel, if required by the Project Specifications or by the Director.

Section D. STEEL AND CASTINGS.

1. Structural Steel: Steel shall conform to the requirements of the Specifications for Steel for Bridges and Buildings, ASTM A6. The grades to be used will be specified in the Project Specifications.

2. Steel Castings: Steel coatings shall conform to the requirements of the Specifications for Mild to Medium-Strength Carbon-Steel Castings for General Application, ASTM A27. The grades to be used will be specified in the Project Specifications.

3. Gray Iron Castings:

   a. Iron castings shall conform to the requirements of the Specifications for Gray Iron Castings, ASTM A48. All castings shall be clean and free of scale, adhesions or inclusions. They shall be completely coated, as required herein.

   b. Gray Iron Castings for manhole frames and covers shall be fabricated of Class 30B cast iron. Bearing surfaces between manhole frames and covers shall be such that the cover shall seat in any position onto the frame without rocking. Bearing surfaces for standard manhole frames and covers shall be machined.

4. Coatings for Castings and Steel Units:

   a. Preparation: Castings that are to be coated shall be clean and free of rust, scale, adhesions, sand or mud. They shall be dry and at a temperature before coating not lower than that of the coating liquid in the dipping vat. They shall be coated by dipping and held in the coating liquid a sufficient length of time to insure complete coverage, adhesion, and adequate thickness as to provide a final hardened coating of approximately 0.01 inch.

   b. Coating Liquid: The coating liquid shall not be diluted or mixed with fillers, but shall be used as recommended by the manufacturer. It shall be kept uniformly mixed to prevent separation or thickening. It shall consist of an asphaltic emulsion containing not less than 53 1/2% asphalt. The base asphalt shall have a softening point not lower than 140 degrees F, and a penetration of 30 to 40. The emulsion shall contain not more than 1 ½ % by weight of ash nor more than 45% by weight of water.

Section E. BRICK.

1. Sewer Brick:

   a. Brick shall conform to the Specifications for Sewer Brick, ASTM C32 for Grade SM. Bricks shall conform to the following dimensions, unless otherwise approved by the Director.

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

b. All brick shall be new and whole, of uniform standard size and with substantially straight and parallel edges and square corners. Bricks shall be of compact textures, burned hard entirely through, tough and strong, free from injurious cracks and flaws and shall have a clear ring when struck together. No soft or salmon brick shall be used in any part of the work. Brick shall be culled after delivery, if required, and no culls shall be used except at such places, to such extent, and under such conditions as may be approved by the Director.

c. The Contractor may be required to furnish the Director with at least five bricks of the character and make the Contractor proposes to use, at least one week before any bricks are delivered for use. All brick shall be of the same quality as the accepted samples.

2. Building Brick: Building brick shall conform to the requirements of the Specifications for Building Brick (Solid Masonry Units Made from Clay or Shale), ASTM C62, Grade MW, with dimensions as required in the Project Specifications.

3. Facing Brick: Facing brick shall conform to the requirements of the Specifications for Facing Brick (Solid Masonry Units Made from Clay or Shale), C216, Grade MW, Type FBS, with dimensions as required in the Project Specifications.

Section F. PRECAST MANHOLES.

1. Reinforced Concrete Manholes: Precast reinforced concrete manholes shall conform to the standard specifications for precast reinforced concrete manhole sections, ASTM-C478 and the approved Standard Details of Sewer Construction. The Portland cement used shall be Type II. All precast sections shall be manufactured with vibrated concrete (wet cast) and provided with an exterior waterproof coating.

2. Manhole Cones: Manhole cones shall be concentric and base sections shall have the base riser section integral with the floor.

3. Manhole Steps: Manhole steps shall be cast into the full depth of the wall section or installed by an approved alternate method.

4. Connections: Connections for inlet and outlet pipes shall be of an approved patented compression type connection.

5. Riser Sections: The minimum inside diameter for the base and riser sections shall be 48 inches.

Section G. PIPE.

1. Sanitary Sewer Pipe: For projects where it is intended to dedicate the sewers to the City for maintenance, or unless otherwise indicated on the project plans or specifications, the following types of pipe may be used:

a. Vitrified clay pipe (VCP).

b. Reinforced concrete pipe with Type "B" joint (RCP).

c. Polyvinyl chloride pipe (PVC)

d. Composite sewer pipe (ABS)

2. Clay Pipe and Fittings: These shall be of the best quality of hard-burned vitrified clay pipe, meeting the latest requirements of the Standard Specifications for Clay Sewer Pipe, ASTM C700. Extra strength pipe shall be used.

   a. The ends of rubber-gasketed pipe shall be formed by machined metal rings and be accurately manufactured so that, when the adjacent pipe sections are drawn together, the rubber gaskets will be uniformly compressed around the periphery of the Pipe to provide a watertight seal.

3. Reinforced Concrete Pipe:

   a. It shall be precast and shall conform to the requirements of the Specifications for Reinforced Sewer Pipe, ASTM C14 or C985. Strength class or classes shall be as required by the Project Plans and Specifications. The interior surfaces of the pipe shall be a smooth true cylindrical surface free from undulations or corrugations. No lifting holes will be allowed for sanitary sewers. Coal and lignite, if present, shall constitute no more than a maximum of 0.25 percent by weight of the fine aggregates. Cement shall meet all the requirements of the Specifications for Portland Cement, ASTM C150, Type II. Cut pipe for curved alignments shall be of uniform cut and length along the same curve, and shall otherwise meet the same requirements as for straight pipe.

   b. When Project Specifications require or the Director orders the use of flexible rubber-type gaskets, the shape, dimensions and tolerances of the bell and spigot or tongue and groove ends of the pipe shall meet all requirements of the Specifications for joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber-type Gasket ASTM C443 or C361 and be subject to the approval of the Director.

   c. The ends of rubber-gasketed pipe shall be formed by machined metal rings and be accurately manufactured so that, when the adjacent pipe sections are drawn together, the rubber gasket will be uniformly compressed around the periphery of the pipe to provide a watertight seal. No lifting holes will be allowed on sanitary sewers.

4. Ductile Iron Pipe:

   a. Ductile iron pipe shall conform to the requirements of American National Standard Specifications for Ductile Iron Pipe Centrifugally Cast In Metal Molds or Sandlined Molds for Water and Other Liquids, ANSI A21.51 (AWWA C151).

   b. Approved ring gasketed slip-type joints shall be used on the ductile iron pipe unless otherwise noted in the Project Specifications.

c. Fitting shall conform to the Specifications for Cast Iron Fittings, 2 inch through 48 inch, for water or other liquid, ANSI A21.10 (AWWA C110).

d. The minimum allowable thickness shall be Class 52, unless otherwise specifically designed on the contract documents.

e. The pipe shall be encased in green polyethylene tubes meeting the requirements of ANSI/AWWA A.21/C105, unless otherwise noted on the contract documents or where the pipe is encased in Class A concrete.

f. The interior of the pipe shall be lined with “Polybond-Plus” as manufactured by American Ductile Iron Pipe Company or the “Protecto 401" lining system.

5. Polyvinyl Chloride Pipes: All PVC pipe (15 inches in diameter or less) shall conform to the requirements of ASTM D-3034 Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. All PVC pipe (18 inches in diameter or larger) shall conform to the requirements of ASTM F-679 Standard Specifications for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings with a minimum pipe stiffness of 46 psi. Fittings for PVC pipe shall be of the same material and strength requirements as the sewer, as well as monolithic in construction, unless approved otherwise in writing.

6. Plastic Pipe For Force Mains: This pipe shall conform to the requirements of AWWA C900 Standard Specification for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch For Water, with approved joint, unless otherwise approved or noted on the contract documents.

7. Cured-in-Place Pipe (CIPP): This shall conform to the requirements of ASTM F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube. The design thickness shall be as approved by the City.

8. Other Types of Pipe: The Director may consider for approval, a written request by the Contractor to use other types of pipe. Special bedding requirements may be required if other types of pipe are approved.

Section H. JOINTS.

1. Joint Selection:

a. The type of joint or jointing material to be used shall be compatible with the specified pipe material as follows:

Material	Type
Vitrified Clay Pipe (VCP)	C
Reinforced Concrete Pipe (RCP)	B

b. When compression joints Type A, B, C or D are specified, a sample joint of a specific type, design material, resiliency, and manufacturer must be submitted for approval by the Director before it may be used. No pipes shall be delivered to the work site without previous approval by the Director.

c. All pipes shall be so handled and stored that the jointing parts and the jointing materials will not deteriorate or be damaged. No joint shall be made under water. The bell, socket, or groove, and the spigot or tongue shall be clean and dry before preparing the joint for laying, and the prepared joint shall be kept clean and dry before and during laying and jointing the pipe. In cold weather, suitable measures must be taken to attain proper adhesion and workability of the jointing material and to insure a satisfactory joint. All work shall be done in an approved manner by skilled workmen so that the completed sewer shall have a continuous smooth uniform invert and interior surface. Care shall be used during laying and jointing of a pipe to avoid disturbing or damaging previously laid pipes and joints.

2. Type A Joints: When used with concrete pipes, they shall be approved compression-type joints and shall conform to the requirements of the Specifications for joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber-type Gaskets ASTM C443. Band-type gaskets depending entirely on cement for adhesion and resistance to displacement during jointing shall not be used.

3. Type B Joints: When used with concrete pipes, they shall be approved compression-type joints and shall conform to the requirements of the Specifications for joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber-type Gaskets ASTM C361 with a 25 foot head. Band- type gaskets depending entirely on cement for adhesion and resistance to displacement during jointing shall not be used.

4. Type C Joints: When used with vitrified clay pipes, they shall be approved factory-molded compression type joints using resilient materials. They shall conform to the requirements of the Specification for Vitrified Clay Pipe joints using materials having Resilient Properties, ASTM C425.

5. Type D Joints: Shall be used with PVC pipes and they shall be elastomeric gasket joints providing a water tight seal. They shall conform to the requirements of the Specification for joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals, ASTM D3212.

6. Other Type Joints: The Director may consider for his approval, a written request by the Contractor to use other types, materials, methods, or kinds of joints.

7. Lubricants for Prefabricated Pipe Gaskets: The material to be used as a lubricant in jointing pipes or fittings fitted with flexible, watertight, rubber- type gaskets, either factory or job-applied shall be compatible with the material of the gaskets and as recommended by the manufacturer.

8. Primers and Adhesives: The material to be used as a primer or adhesive for jointing materials or for prefabricated gaskets shall be compatible with the material of the gasket or jointing materials. Adhesives used to fasten flexible rubber or rubber-type gaskets shall conform to the requirements of the manufacturer of the gaskets.

9. Adapters and Couplings:

   a. At the direction of the Director or as noted on the contract documents, connection of sanitary sewer pipe (4 inch through 18 inch) of dissimilar material or of different sizes or for the repair of sanitary sewer pipes of similar materials may be

made by means of an approved connector or adapter of the compression or mechanical seal type.

b. The connector or adapter shall be manufactured of an approved pre-formed elastomeric material conforming to applicable sections of ASTM Standards C425, C443, C564, and D3212. Couplings of the mechanical seal type shall 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 A167. If a stainless steel shear band is not used, a concrete collar, as shown in the Standard Details is required.

c. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer. Each connector and adapter shall bear the manufacturer's name and required markings.

d. All costs associated with the connection of pipe shall be included in the unit price pay items for pipe and not paid for separately.

Section I. CRUSHED LIMESTONE AND SCREENINGS FOR SEWER BEDDING, BACKFILL AND SUBGRADE REPLACEMENT MATERIALS.

1. Requirements: All stone or crushed limestone shall be sound, durable and free from Cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated.

2. **Designation: Type 1 - Bedding.** For pipes 27 inch in diameter and smaller, bedding shall meet following gradation:

Type 1 - Bedding (% by Weight Passing)		
Sieve	**Maximum**	**Minimum**
1 inch	100	100
¾ inch	100	90
½ inch	60	35
# 100	10	0

3. **Designation: Type 2 – Bedding.** For pipes 30 inch in diameter and larger, bedding shall meet the following gradation:

Type 2 - Bedding (% by Weight Passing)		
Sieve	**Maximum**	**Minimum**
1-1/2 inch	100	100
1 inch	70	60
¾ inch	50	40
½ inch	35	25
#100	10	0

4. **Designation: Type 3 – Backfill.** Crushed limestone and screenings to be used for backfill shall be 3/4 inch minus.

5. **Designation: Type 4 - Subgrade Replacement.** Crushed limestone and screenings to be used for subgrade replacement shall be crusher-run, 2-1/2 inch maximum size (95% to 100% passing a 2-1/2 inch screen) graded to allow satisfactory compaction.

6. **Designation: Type 5 - Rock Blanket - Light.** Light limestone rock shall be at least 7 inches in size and all stones shall weigh not less than 25 pounds, and at least 75 percent shall weigh not less than 50 pounds.

7. **Designation: Type 6 - Rock Blanket - Heavy.** Heavy limestone rock shall be at least 12 inches in size and all stones shall weigh not less than 50 pounds, and at least 60 percent shall weigh not less than 100 pounds.

Section J. GEOTEXTILE FABRIC.

1. **Designation: Type 1.** Fabric for the use under rock blanket. Geotextile shall be needlepunched nonwoven polypropylene fibers.

   a. Minimum Average Roll Values (MARV)
   Mechanical Properties

Grab Tensile Strength ASTM D4632	300 Lbs.
Grab Tensile Elongation ASTM D4632	50%
Trapezoid Tear Strength ASTM D4533	115 Lbs.
Mullen Burst Strength ASTM D3786	580 psi
Puncture Strength ASTM D4833	175 Lbs.
UV Resistance After 500 Hrs. ASTM D4355	70% Strength

   b. (MARV)
   Hydraulic Properties

Apparent Opening Size ASTM D4751	100 U.S. Sieve
Permittivity ASTM D4491	0.8 / SEC

2. **Designation: Type 2.** Fabric for pipe bedding stabilization shall be woven polypropylene yarns. Geotextile shall be wrapped around aggregate subgrade below pipe.

   a. (MARV)
   Mechanical Properties

Wide Width Tensile Strength (Ultimate) ASTM D4632	400 Lb. / In.
Grab Tensile Elongation ASTM D4632	120%
Trapezoid Tear Strength ASTM D4533	180 Lbs.
Mullen Burst Strength ASTM D3786	1,200 psi
Puncture Strength ASTM D4833	160 Lbs.
UV Resistance After 500 Hrs. ASTM D4355	70% Strength

   b. (MARV)
   Hydraulic Properties

Apparent Opening Size ASTM D4751	30 U.S. Sieve
Permittivity ASTM D4491	0.4 / SEC

PART 3 - EXCAVATION

Section A. GENERAL.

1. Type: The Contractor shall make all excavations required for constructing all sewers and appurtenant structures as required by the Project Plans and Specifications. Except where otherwise required by the Project Plans and Specifications, or ordered in writing by the Director, all excavations shall be in open cut to the specified widths and depths.

2. Protection: The Contractor shall be responsible for the conditions of all excavations made by the Contractor and shall properly and adequately protect the excavation from caving or sliding. All slides and cave-ins shall be handled, removed, or corrected by the Contractor without extra compensation at whatever time and under whatever circumstances they may occur. To confirm the existence or change in classified excavation or the location of underground obstructions and conditions, the City may require a reasonable number of test pits to be dug by the Contractor along the lines of the sewer, as shown on the drawings, in advance of the excavation. No additional payment will be made for this work unless the test pits are in a paved area or the number of test pits should exceed one test pit per reach of new sewer.

Section B. CLASSIFICATION OF EXCAVATION.

1. Excavation Classes: There shall be three classes of excavation:

    a. Class A: Any material in original beds, or well defined ledges such as solid limestone, hard sandstone, or hard shales. Also, any material where each piece is more than one cubic yard in volume such as large boulders, detached pieces of limestone, hard sandstone, or mass concrete.

    b. Class B: Densely packed materials such as most shales, soft sandstone, or rubble. Also, detached pieces of material each being more than one cubic foot in volume such as broken concrete or rock. If the contractor chooses and is permitted to use drilling, blasting, or wedging for the removal of Class B material, such material will be measured and classified as Class B and not Class A.

    c. Class C: All materials not included in Class A and Class B excavation.

2. Record of Excavation Materials: The class of excavation, with its location and dimensions, shall be recorded in the Director's record of the work. The results of borings are shown on the Project Plans for design purpose only, and without any expressed or implied agreement or guarantee that depths or character of materials are correctly shown, or that conditions affecting the work will not differ from those shown on the plans. If the contractor desires to make his own investigations and borings, and so requests in due time, the City will provide the necessary access to the site.

Section C. CLEARING.

1. This work shall consist of removal, grubbing, and disposing of all vegetation such as trees, bushes, shrubs, plants, vines, brush, weeds, and sod necessary for the construction of the project, as well as, removing and properly disposing of all trash and railroad ties. At the City's direction, specific trees, shrubs, or plants may be required to be removed and properly disposed of or left in place and protected. If trimming of trees

is required to accommodate equipment, it shall be done prior to starting excavation. Upon the direction of the Director, railroad ties shall be removed and stacked on the property and not removed from the site, remaining the property of the original owner.

Section D. WORK INCLUDED IN EXCAVATION.

1. General: All of the following items are included in excavation, unless otherwise directed or provided by the Project Plans and Specifications.

    a. The removing of all surface obstructions in streets, alleys, rights of-way, easements, and public places.

    b. The making of all necessary excavations.

    c. The providing of all necessary clearing.

    d. The furnishing and installing of all shoring and bracing as necessary or directed.

    e. The pumping, controlling and bailing to keep trenches free of ground water and infiltration during pipe laying and jointing, and thereafter until each joint, mortar, or concrete is set.

    f. The providing for uninterrupted surface water flow during work progress.

    g. The providing for bypass pumping and properly disposing of flows from sewers, storm drains, creeks, or other sources.

    h. The protecting of all pipes, conduits, culverts, tracks, utility poles, wires, fences, buildings, and other public and private property adjacent to or in the line of work.

    i. The removing of all shoring and bracing not ordered or required to be left in place.

    j. The hauling away and disposing of all excavated or disturbed materials within the “working room” limits not necessary or else unsuitable for backfilling purposes.

    k. The backfilling by mechanical compaction of all excavated trenches, except where granular backfill is required by the Project Plans and Specifications.

Section E. UNUSUAL EXCAVATION CONDITIONS.

1. Extra Payment Requests: The Contractor may make detailed requests to the City in writing for extra payment to the Contractor by the City for additional costs involved in fulfilling the Contract because of the following unusual conditions if these are not covered by pay items in the Contract:

    a. Unusual infiltration of ground water into the trench requiring the use of well-points or other special dewatering methods, if considered necessary and ordered by the Director.

    b. Necessity for using sheet piling, if considered necessary and ordered by the Director.

c. Other unforeseeable, special, or unusual construction required to protect life and property when ordered by the Director.

2. Written Request For Special Items: Before the Contractor incorporates any of the above special items of work for which the Contractor expects reimbursement, the Contractor shall make a written request to the Director and receive his written approval of the use of such special methods, which are defined above. Such request to the Director shall include a detailed statement of the additional costs involved.

Section F. OPEN CUT EXCAVATION.

1. Alternative Methods of Excavation: Unless otherwise shown on the plans, all excavation for construction of sewers and their appurtenant structures shall be in open cut from the surface. Unless otherwise shown on the plans, tunneling, stanking, boring or jacking, will be allowed only on permission of the Director, with the requirement that a complete record thereof shall be kept in the project records.

2. Underground Structures, Pipe Lines, or Utilities: The Contractor shall proceed with caution in any excavation and shall use every means to determine the exact vertical and horizontal location of underground structures, pipe lines, conduits, etc. (including sanitary manholes, sewers and laterals), prior to excavation in the immediate vicinity thereof. When there is reason to believe that a utility conflict may exist, the Contractor shall determine the plan and elevation location of the suspected utility in conflict prior to commencing work on reaches adjacent to the reach in which the utility conflict may occur. This will enable the City to evaluate field adjusting lines or grade to avoid potential conflicts. This field verification of utility locations and existing sewers shall be accomplished at no additional cost to the City.

3. Utilities:

   a. Whenever it becomes necessary to perform any work on any public or private utility, the Contractor shall make satisfactory arrangements for such work with the affected utility.

   b. The City has shown on the Project Plans the readily available record of location of existing structures and facilities, both above and below the ground, but assumes no responsibility for the accuracy or completeness of this information. Utility service connections will not be shown on the Plans, but reasonably can be expected in built-up areas, and if it is necessary to relocate them, it shall be the Contractor's responsibility. If the method of operation for the construction of the sewers requires the removal and replacement or protection of any overhead wires or poles, the Contractor shall make satisfactory arrangements for such work with the owners of such wires and poles and no additional payment will be made.

   c. It shall be the Contractor's responsibility to protect any sewer or utility within the limits of the construction. The City will not be responsible for the cost of protection or repair or replacement of any structure, pipe line, conduit, service connection, etc., above and below ground which may be broken or otherwise damaged by Contractor’s operations. All water and gas pipes and other conduits adjacent to or crossing the trench must be properly supported and protected by the Contractor. Sewer and utility services between mains and buildings shall be maintained by the Contractor in as nearly a continuous operation as reasonably

can be expected. This shall be accomplished in any way that the Contractor may desire, provided that the individual service must not be inoperative more than six consecutive hours. When a break occurs, the Contractor shall notify the affected householder of the probable length of time that the service will be cut off.

4. Limits of Excavation for Pipe Sewers:

   a. Except where otherwise shown in the Project Plans and Specifications, or where ordered by the Director, trenches shall be excavated to the depths shown on the plans and to the payline widths shown in of the Standard Details of Sewer Construction. Excavated materials will be classified for measurement and payment as specified.

   b. The sides of the trench shall be vertical, and the width of the trench below a level one foot above the outside top of pipe shall not exceed the payline widths for pipe sewers set forth in the Standard Details, unless specifically so provided in the Project Plans. If the trench width at or below that level exceeds the payline width, provision shall be made for the additional load upon the pipe as required by the Director and the Standard Details.

5. Change of Trench Location: If the Director orders that the location of an excavation be moved a reasonable distance from that shown on the drawings, due to an obstruction or other cause, or if a changed location is authorized at the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damage, if the change is made before the excavation is begun. If such a change is made at the order of the Director, and involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill will be measured, classified, and paid for in the same manner as other trench excavation and backfill of the same character. If the excavation is abandoned in favor of a new location at the Contractor's request, abandoned excavation and backfill shall be at the Contractor's expense. If an obstruction should lie within the excavation in such manner that the trench has to be excavated to extra depth or width in order that sheeting or bracing may be properly placed, or in order that the structure to be placed in the excavation may be properly built, such extra depth and width of the excavation shall be measured, classified, and paid for in the same manner as other trench excavation and backfill of the same character.

6. Length of Open Trench: The length of trench which may be opened in advance of the completed sewer shall be limited to 200 feet in earth, except with permission of the City. In rock, the length shall be sufficient to protect the completed sewer.

7. Unauthorized Excavation:

   a. All unauthorized excavation carried beyond or below the lines and grades given by the Project Plans or Specifications, together with the removal of such excess excavated materials, and the cost of refilling the space of such overdig or unauthorized excavation, shall be at the Contractor's expense.

   b. The excess space between the undisturbed bottom and sides of the excavation and pipe bedding shall be refilled and compacted with crushed limestone as directed by the City.

8. Removal of Unsuitable Subgrade: Soft or spongy earth, muck, mud, unconsolidated earth fill, unsuitable fill such as decayed vegetable or organic matter, or soft, friable,

unconsolidated materials such as ashes or rusted cans, or any other materials unsuitable as a firm base for the pipe or sewer or structure shall be removed, as ordered by the Director, and shall be replaced with compacted crushed limestone. The Contractor will be paid for the additional excavation as specified, except where the unsuitable base is caused by the activity of the Contractor or by his failure to control water in the trench.

9. Excavation in Rock:

   a. Trench bottoms in rock shall be excavated to a depth below the outer pipe bottom as shown on the Standard Details, and to the maximum payline width at and below the outside top of the pipe with no point or rock being closer than four inches from the pipe barrel. The responsibility of the Contractor with respect to the use of explosives in blasting includes compliance with all laws, rules and regulations of the federal, state and local municipalities and the insurer governing the keeping, storage, use, manufacturer, sale, handling, transportation, or other disposition of explosives. All operations involving the handling, storage, and use of explosives shall be conducted with every precaution under the supervision of a properly licensed individual. The Contractor shall take special precautions for the proper use of explosives both at or near the top of the excavation and in the excavation in order to prevent harm to human life and damage to surface structures, utilities, sewers or other subsurface structures. The Contractor shall advise the Director in advance when charges are be set off. Blasts shall not be fired until all persons in the vicinity have had ample notice and have reached positions of safety.

   b. After a blast is fired, the Contractor shall cause the excavation to be thoroughly scaled. All loose, shattered rock or other loose material which may be dangerous to the workmen, pipe, or structure, shall be removed and the excavation made safe before proceeding with the work. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the Contractor from the necessity for making such removal and filling the extra space. The Contractor shall not be entitled to extra compensation therefore.

10. Control of Water:

   a. While sewers and appurtenances are under construction, the Contractor shall keep all excavations free of water at Contractor's own expense. The Contractor shall provide all dams, flumes, channels, sumps, or other works necessary to keep the excavation entirely clear of water and shall provide and operate pumps or other suitable equipment of adequate capacity for the control of water in the excavations. No additional payment will be made for control of water in excavations or other construction techniques required for installation of the pipe under or adjacent to existing bodies of surface water (rivers, creeks, ditches, ponds, etc.). The Contractor shall avoid producing mud in the trench bottom by his operations, and if necessary or so ordered, shall place crushed limestone at his own expense to maintain a firm dry excavation bottom and base. Pipe bedding, laying, jointing, and the placing of concrete or masonry shall be done in a water- free trench or excavation, which shall be kept clear of water until pipe joints, concrete and masonry have set and are resistant to water damage. The water shall be disposed of in a manner approved by the Director.

b. All gutters, pipes, drains, conduits, culverts, catch basins, stormwater inlets, ditches, creeks, and other stormwater facilities shall be kept in operation, or their flows be satisfactorily diverted and provided for during construction. Any facilities disturbed during construction shall be restored to the satisfaction of the Director. All costs of handling water and providing a stable subbase during construction shall be included in the prices bid for the various classes of excavation.

11. Disposition of Excavated Materials:

a. Excavated materials suitable for backfill shall be stored no closer than two feet from the edge of the excavation. They shall not obstruct crosswalks, sidewalks, street intersections, nor interfere unreasonably with travel on the street by occupants of adjoining property. Gutters or other surface drainage facilities must not be obstructed. When clear access to fire hydrants, mail boxes, sewer and conduit manholes, gas stops, and similar utility or municipal service facilities is required, the Contractor must provide such access. Handling and storage of excavated materials must meet the requirements of local government agencies having jurisdiction.

b. All materials, excavated, or disturbed, or damaged, or removed by the Contractor and not to be used for refilling trenches, channels, or structure excavations, nor to be used in restoration of subsurface or surface facilities or conditions, shall be removed from the site and disposed of by the Contractor at his expense, unless otherwise directed. If the Contractor proposes to store or place such excess excavated material upon any property, written consent of the property owner or owners must be secured in advance and a certified copy or copies thereof be filed with the Director. No surplus or excess materials shall be deposited in any stream channel, floodway, floodplain, nor in any place where pre-construction surface drainage would be changed, without written permission of the Director.

12. Bracing and Shoring:

a. The Contractor shall furnish, place, and maintain such sheeting, bracing, shoring, etc. as necessary or may be required to support the sides of the excavation to protect workmen in the trench and to prevent any earth movement which might in any way injure or delay the work, change the required width of the excavation, or endanger adjacent pavement, utilities, sewers, buildings, or other structures above or below the ground surface. The sheeted trench width, as measured between those faces of the sheeting in contact with the earth trench wall, shall not exceed the payline width of trench below an elevation one foot above the top of the pipe. Walers and other bracing shall be so designed and installed as to present no obstructions to proper placement of the pipe, bedding, cradle or encasement, nor shall they interfere with the satisfactory laying and jointing of the pipe.

b. Sheeting, bracing, and shoring shall be withdrawn and removed as the backfilling is being done, except where and to such extent as the Director shall order that such sheeting, bracing, and shoring be left in place, or where the Director will permit the same to be left in place at the Contractor's request. In any case, the Contractor shall cut off any such sheeting at least two feet below the surface and shall remove the cutoff material from the excavation.

c. All sheeting, bracing, and shoring which is not left in place under the foregoing provisions shall be removed in a manner as not to endanger the completed work or other structures, utilities, sewers, or property, whether public or private.

13. Trenches with Sloping Sides: Where working conditions permit and where the necessary agreements have been made with the affected property owners, and the Director has given approval, the Contractor may excavate the upper part of sewer trenches with sloping sides above a level one foot above the top of the pipe. Trench excavation below this level shall be carried out with vertical sides having a width between vertical earth sides not greater than the payline width shown in the Standard Details. Bedding, concrete cradling, or encasement shall be specified for vertical side trenching. All trenches in highways, streets, or alleys shall be excavated with vertical sides.

14. Stanking:

a. Where required by the Project Plans or ordered by the Director, a line of open trench excavation will be interrupted by a stank or short section of unexcavated earth with an excavated opening beneath for constructing the pipe sewer, in order to avoid disturbing existing improvements or the necessity of removing surface or subsurface structures. The locations of the stank faces will be set by the Director.

b. The excavated opening shall be sufficiently large to provide adequate working room for proper bedding, installing the pipe sewer, and compacting the backfill. The top of the opening shall be sloped sufficiently to permit solid backfilling without voids. The Contractor may undercut the stank at its face if permitted by the Director, but only in such amount that will maintain a depth of stank at the face not less than twice the actual trench width, and will insure safety of the improvements or structures for which stanking was required.

Section G. EXCAVATION FOR MANHOLES AND OTHER APPURTENANT STRUCTURES.

1. Limits of Excavation: The Contractor shall excavate as required for all structures with foundations carried to firm, undisturbed earth at the elevation of the underside of the structure. In rock, the Contractor shall excavate all rock at least to the minimum limits shown on the Standard Details for trenches and to the grade of the bottom of the manholes, junction chambers, or other structures as required by the Project Plans. Where the bottom of the excavation for structures is in rock, no rock shall project above the lower surface of the concrete or brick masonry base in such a manner as to reduce the required thickness of such base. All spaces between the bottom of such base and the solid rock surface shall be completely filled with the same materials used for the foundation or base, placed simultaneously as an integral part of the foundation or base.

Section H. METHODS OF MEASUREMENT AND BASIS OF PAYMENT.

1. Clearing: Payment for "Clearing" shall include all costs incurred due to "Clearing", protecting trees, shrubs, and plants, as well as, properly disposing of all trash and railroad ties. Payment will be made for "Clearing" at the Lump Sum price as bid per the Project Specifications. If there is no specific pay item, all costs for "Clearing" shall be included in excavation.

2. Trench Excavation:

   a. The volume of excavation for which payment will be made will be determined for each size of pipe and for each class of excavation as computed from actual final measurements and from measurements made during construction. The total volume of excavation for each size of pipe sewer laid shall be computed as a square-bottomed trench with vertical sides separated a distance equal to the payline trench width given in the Standard Details, a length equal to the actual horizontal distance between the payline limits for excavation of the connected structures; and a depth equal to the average vertical distance, measured at twenty-five foot intervals from a point directly below the pipe flow line, a distance equal to the pipe wall thickness plus four inches or six inches, as applicable, to the bottom of concrete pavement base, the original surface of the ground, or the roadway surface. No additional measurement, computation, or payment will be made for excavation for pipe bells.

   b. In case that either or both Class B or Class A excavation is encountered, the volume of each class of excavation will be computed from its limits and location in the trench, similarly measured as described for Class C excavation.

   c. In the event that any Class B or Class A excavation is authorized by the Director to be removed, less than a full payline width across the trench, to facilitate the proper installation and bedding of the new pipe, the volumes of Class B or Class A excavations will be computed as if the full payline width entirely contained these same appropriate classifications of excavations from their limits in the trench.

   d. When construction of a new sewer requires excavation of existing sewer pipe or structures, the removal of the existing pipe or structures shall be paid for as Class "C" Excavation. The pay volume for this excavation shall be the full payline volume as previously defined with no deduction for the void within the existing pipe or structure.

3. Excavation for Structures: Unless the Project Plans and Specifications stipulate that a lump sum or unit price for any specific structure shall include the entire cost of excavation and backfill related to that structure, the volume of excavation shall be measured and computed as follows:

   a. For structures other than manholes, the volume of excavation for which payment will be made will be computed as a prism with vertical walls, with a base extending 12 inches from the outermost lines of the structure base, and with a height equal to the average vertical distance between the bottom of the structure base and the bottom of the concrete pavement base or the original surface of the ground, or the roadway surface.

   b. For manholes the volume of excavation for which payments will be made will be computed as a prism with vertical walls, with a base extending six inches from the outermost lines of the structure base, and with a height equal to the average vertical distance between the bottom of the structure base and the bottom of the concrete pavement base or the original surface of the ground, or the roadway surface.

c. In case that either or both Class B or Class A excavation is encountered, the volume of each class of excavation will be computed from its limits and location in the trench, similarly as described for Class C excavation.

4. Removal of Unsuitable Subgrade: When the Contractor is ordered to remove unsuitable subgrade beyond the paylines the volume of such removal as directed will be computed from actual measurements. Payment will be made for the computed volume at the unit bid price per cubic yard for Class C excavation and for an equal volume of compacted crushed limestone. If the unsuitable material is mud or muck caused by the activity of the Contractor or by his failure to provide adequate drainage for the excavation, no payment shall be made for the removal or replacement of such material.

5. Payment for Excavation: The payment for Class A, B, or C excavation will be made for the computed volumes of each at the respective bid unit price. Such payment shall cover the whole cost of providing all the labor, tools, equipment, materials, and any other requirements for the removal, storage, and rehandling of any surface materials, unless covered by other prices bid in accordance with the Project Plans and Specifications; for the excavation of all materials encountered, for necessary or required sheeting and bracing, and for the backfilling and mechanical compaction of the excavation around the completed structure, except where granular backfill is required, specified, or ordered.

6. Material to Replace Unsuitable Subgrade: The quantity of replacement material for unsuitable subgrade which has been removed from the bottom of the trench or from the structure subgrade, shall be measured and computed in the same manner as described for measuring and computing the volume of excavation of unsuitable subgrade materials.

7. Lumber Ordered Left in Place: The cost of furnishing, placing and removing all bracing, sheeting, etc., of any kind, shall be included in the bid prices for the various classes of excavation. For lumber that has been ordered left in place by the Director, the Contractor will be paid for the computed amount at the price specified per thousand feet board measure for "Lumber Ordered Left in Place", which shall be considered to be the salvage value of the lumber. No payment will be made for any lumber left in place at the election of the Contractor with permission of the Director.

8. Excavation in Earth Tunnel: Payment for Class C excavation in earth tunnel will not be made as a separate item, but is included in the payments made for completed sewer in tunnel. If Class A or Class B excavation is encountered in the tunnel, excavation and payment for such material will be made as described for sewers in tunnel in earth.

9. Payment for Stanking: No additional payment will be made for stanking where required in the project plans and specifications but payment will be made under appropriate pay items as if that portion of the trench were made in open cut.

10. Payment for Sanitary House Laterals and Utility Removal and Relocation:

    a. When it becomes necessary to remove or relocate an existing sanitary house lateral service, utility service, utility main or utility pole, the cost of which is to be paid by the City, the service must be in direct conflict with the new sewer and the work must be authorized by the Director prior to any such removal or relocation.

    b. For sanitary house laterals all cost involved for reconnecting the service, but excluding the cost for granular fill, paving replacement, and curb replacement will

be paid for under the unit bid price per lineal foot of in place 6 inch pipe. For sanitary house laterals which are not in direct conflict with the new pipe but are removed or replaced or relocated, no separate payment will be made.

c. The removal and relocation of water service connections will be paid for under the unit bid price, per place, for "Relocation of Water Service."

d. Any removal or relocation of cable T.V., gas services, utility mains or poles shall be paid for at the exact amount for the cost of such removal or relocation as billed by the utility company. The amount under the extended price for pay item "Utility Relocation" shall be included in the total bid price.

11. Payment For Unusual Underground Facilities:

a. When unusual underground facilities, such as sprinkler systems, electric dog fences, or other facilities are indicated on the Project Plans in close proximity to actual location, and removal or interruption cannot be avoided, payment for the repair or replacement of those facilities shall be included in the amount bid for pay item "Protection and Restoration of Site."

b. When unusual underground facilities are not indicated on the Project Plans or the exact location of same is unknown, and the Contractor has made a reasonable effort to locate the facilities, payment for the repair or replacement of those facilities shall be made in accordance with provisions of Section E, Part 3 of this Standard Specification.

PART 4 - PIPE SEWER CONSTRUCTION

Section A. GENERAL.

1. General Construction Conditions:

   a. Pipe sewers shall be constructed of the sizes, classes and materials and to the alignments and grades given by the Project Plans and Specifications. All pipe shall be inspected on delivery and such pipe as does not conform to the requirements of these specifications and which are not suitable for use shall be rejected and immediately removed from the site of the work or destroyed.

   b. All materials shall conform to the requirements of the pertinent current specifications of ASTM and Part 2 of this Standard Specification, except as otherwise specified in the Project Plans and Specifications.

   c. The grade shown on the profiles to which the work must conform is that of the pipe flowline or the low point of the pipe invert. Construction stakes are the responsibility of the Contractor and will be set at 25-foot intervals for control of alignment, grades and excavation quantity computations. If a laser system is utilized, the construction stakes will be set at each structure, 25 feet upstream, and continuing at 100 foot intervals. Cut sheets are required to be submitted, and must be prepared by a Licensed Surveyor or Engineer.

   d. For sewer pipe with a design grade less than one percent (1%), verification of the pipe grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements. The Contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the City Inspector upon request. Field surveyed verification must be made under the direction of the licensed land surveyor registered engineer. The Contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The City also reserves the right to require the Contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance stated in the above paragraph. The Contractor shall be responsible for any cost associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.

Section B. FIELD TESTS.

1. General: The Contractor shall be responsible for the following:

   a. Performing and recording all tests on sanitary sewer systems in the presence of a City Inspector.

   b. Furnishing all equipment, mandrels, hoses, water, piping connections, test pumping equipment, pressure gauges, pumps, bulkheads, regulators, and any other miscellaneous items as required. Certification of gauges will be required

from the gauge manufacturer. Certification and calibration data shall be available to the Director whenever air tests are preformed.

c. Any by-pass pumping as required.

d. Making any corrections, repairs or replacement as a result of the tests. Having the corrections, repairs or replacement inspected and approved and completing retesting of any part of the system that failed during any initial tests.

e. Payment of all cost associated with field tests or retesting including all costs associated with any required correction, repair or replacement of the sanitary sewer system. No separate payment will be made for field tests or the corrections, repairs or replacement of the sanitary sewer system required to meet these field tests.

2. Air Testing. Air testing shall be performed after completion of the backfill operation. As applicable, for pipe diameters 8 inch through 27 inch, the air test for leakage shall conform to ASTM C-828 “Standard Test Method For Low-Pressure Air Test Of Vitrified Clay Pipe Liners” or ASTM F-1417 “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air”. The air test shall not be conducted unless the pipe is secured so that the application of air pressure will not separate the pipe joints. All branches, laterals, tees and wyes shall be plugged and braced adequately to withstand the test pressure. Air testing shall start with a stabilized test pressure of 3.5 psi. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test. The test time for each type of pipe shall be as indicated in the appropriate ASTM specification.

3. Mandrel Testing. Prior to construction approval, after completion of the backfill operation and the jetting or compaction processes, all flexible pipe shall be tested, by the use of an approved nine arm mandrel to insure that no pipe deflection has occurred greater than 5.0 % of the inside diameter of the pipe. These tests shall be performed without mechanical pulling devices and without additional cost to the City. Ductile iron pipe will not require a mandrel test unless required by the Project Plans or Specifications.

4. Manhole Testing: All manholes shall be tested by vacuum testing after the completion of the sanitary sewer system. The vacuum test shall be in accordance with ASTM C-1244 “Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test”. The required test period is one minute (minimum) for all sizes and manhole depths. After the complete installation of the manhole, including the frame installation, a vacuum test shall be performed at 10” Hg (mercury). After the pressure has stabilized, a maximum of 1” Hg drop in a minimum of one minute will be allowed for manholes up to 48 inches in diameter. For larger manholes, the time for a maximum of 1” Hg drop shall be a minimum of two minutes. If the vacuum test fails to meet the above requirements, repeat test after all leaks and defects have been repaired.

5. Closed Circuit Television Inspection: After the Contractor has completed the above noted field tests on the sanitary sewer system and prior to construction approval, the City, at their own expense, will televise and videotape each sewer reach. Any defects noted by the City during this inspection shall be repaired by the Contractor at no additional cost to the City.

Section C. BEDDING.

1. Bedding, Cradling, or Encasement Types: The Project Plans and Specifications will indicate the specific type of bedding, cradling, or encasement required in the various sections of the pipe sewer construction. The types and detailed requirements of bedding, concrete cradling, and concrete encasement are shown in the Standard Details of Sewer Construction.

2. Use of Bell and Spigot Pipe: Where bell and spigot pipe is to be used, provision must be made for suitable bell holes to avoid pipe support on the bells and to insure continuous uniform bearing and support at the specified grade for the pipe barrel between pipe bells. No blocks, wedges, or other devices shall be used to support the pipe or to prevent uniform bearing of the pipe on its bedding.

3. Class C Bedding:

    a. The standard bedding is Class C. It is to be used when the trench width below one foot above the top of the pipe does not exceed the payline width as shown in the Standard Details. The bedding shall be placed as shown in the Standard Details of Sewer Construction.

    b. The bedding must be compacted to 90% modified proctor density.

Section D. PIPE LAYING.

1. Handling of Pipe: Equipment used to handle, lay and joint pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. Damaged pipe or jointing material shall not be installed.

2. Laying of Pipe:

    a. Pipes shall be laid true to the lines and grades given on the plans. The bell or groove end shall be laid upstream with the ends abutting to form a concentric joint without shoulders or unevenness of any kind along the invert of the pipe. Bell holes shall be dug to relieve the bell of all load and to be no larger than necessary. For all pipe required to be laid to a curved alignment, three copies of a proposed laying diagram must be submitted to the Director and approved prior to construction.

    b. Suitable means shall be used to force the spigot end of the pipe into the bell end without damage to the pipe and its jointing materials, and without disturbing the previously laid pipes and joints. The maximum allowable joint width measured on the inside surface of concrete pipe shall not be more than: 3/4 inch for pipe sized 12 inches through 21 inches in inside diameter; 1-inch for pipe sizes 24 through 45 inches in inside diameter; 1-1/4-inch for pipe sizes 48 inches and larger in inside diameter. On curved alignments only, the foregoing limits may vary a maximum of fifty percent.

3. Joints: When the width of any joint exceeds the foregoing limits, or the infiltration, exfiltration allowables are exceeded, the Director will determine the acceptability of the joint, the requirements for acceptable repair, or will reject the joint to require relaying and rejointing.

4. Bedding, Cradling, or Encasement:

   a. Care shall be taken to insure that the pipes are solidly and uniformly bedded, cradled, or encased in accordance with the type of bedding, cradle, or encasement required by the Project Plans and Specifications, and as shown in the Standard Details of Sewer Construction. No pipes shall be brought into position until the preceding length has been bedded and secured in place.

   b. Where concrete encasement is required, the pipe shall be supported at not more than two places with masonry supports or selected cut hardwood (as approved by the City) of minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete.

5. Lifting Holes: Lifting holes in pipe are not allowed.

6. Water in Excavation: Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage to the pipe and the joints during backfilling or at any other time.

7. Cleaning of Pipe Interior: As the work progresses, the interior of the sewer shall be cleaned of all dirt, cement, extruded joint materials, debris, and other extraneous materials.

8. Protection of Pipe: Whenever pipe laying is stopped for any significant length of time, such as at the end of a workday, the unfinished end shall be protected from displacement, flotation, cave-in, in-wash of soil or debris, or other injuries. A suitable temporary tight-fitting plug, stopper, or bulkhead shall be placed in the exposed bell, groove or socket end.

9. Fittings and Special Pipes: Tees (T-junction), wyes (Y-junction), slants, stubs, reducers, bends, elbows, curves, radius-pipe, curved pipe, fittings, or other special pipes shall be installed at the places shown on the Project Plans or where ordered by the Director. The fittings and special pipes shall be made of a compatible material, type, and class or strength designation as the pipe required by the Project Plans and Specifications, and shall be installed in accordance with the pertinent Standard Details of Sewer Construction and these specifications.

10. House Connections: Wye and tee-branches may be used on pipes for house connections and shall be encased in mixture of one volume of cement and three volumes of moist sand.

11. Future Connections: Wye and tee-branches, slants, stubs, or other fittings installed in the pipe or built into manholes, junction chambers, or appurtenant structures for future connections shall be closed at the outer end. For pipes 21- inches in diameter or smaller, an approved stopper or cap shall be installed in the bell or socket using the same type joint or jointing material as required for the sewer. For pipes 24-inches in diameter and larger, temporary approved masonry bulkheads to close the outer end shall be constructed of the thickness as required by the Project Plans and Specifications. Care in backfilling shall be used so that such closure and its seal will not be disturbed.

12. Force Mains:

a. Where a force main is required by the Project Plans and Specifications, it shall meet the requirements of Part 2, "Materials of Construction."

b. The force main shall be provided with appropriate appurtenances where necessary, such as automatic air relief valves, thrust blocks, cleanouts, and cleanout manholes at low points in force main.

c. The force main shall be bedded in carefully placed selected earth backfill unless otherwise shown on the Project Plans and Specifications.

d. The force main shall be laid on a continuous rising grade from the lift station or cleanout manhole to the manhole on the gravity sewer.

e. After backfilling has been completed, the force main shall be tested to a pressure of 50 P.S.I. above the normal operating pressure of the system, unless otherwise specified. The leakage shall be measured by pumping into the line with a pump capable of maintaining the required pressure and metering the amount of water necessary to sustain the pressure for a period of four hours. The test when so conducted, shall indicate a leakage of not more than 50 gallons per inch of pipe diameter per mile per day and no leaks shall become apparent on the surface of the ground. Should surface leaks become apparent, or should the leakage exceed that specified, the leaks shall be located and repaired and the line retested until it fulfills the above requirements.

Section E. CONCRETE CRADLE.

When a concrete cradle is required by the Project Plans and Specifications, it shall be of low slump Class "A" concrete. It shall be constructed according to the details in the Standard Details of Sewer Construction. Backfill materials may not be placed above the concrete until it attains its initial set.

Section F. CONCRETE ENCASEMENT.

When an encasement is required by the Project Plans and Specifications, it shall be a low slump Class "A" concrete. It shall be constructed according to the details in the Standard Details of Sewer Construction. Backfill materials shall not be placed until the concrete attains its initial set.

Section G. STRUCTURES.

1. General: The Contractor shall build manholes, junction chambers, and such other miscellaneous structures as are required at the locations shown on the Project Plans, and of the forms, dimensions, and materials as shown in the Standard Details of Sewer Construction or Project Plans and Specifications or as otherwise directed. The structures will be of concrete, plain or reinforced as required. Where the top elevation is not shown on the plans, the structure or appurtenance shall be built to conform to the elevation ordered by the Director.

2. Vertical Alignment:

   a. The various structures shall be built as the pipe laying or sewer construction progresses. The Director, at his discretion, may stop the laying of pipe or the building of other structures until the structure just passed has been completed. Completion of the structure shall include the installation of fittings and connections to pipes and other construction as shown on the plans.

   b. Structures shall not be out of plumb more than one foot in thirty feet of depth.

3. Concrete Structures:

   a. Where concrete structures are permitted or required by the Project Plans, they shall be built of Class “A” concrete as shown in the Standard Details of Construction or on the Project Plans. The structure shall be built on prepared foundations, conforming to the dimensions and shapes shown on the plans. The construction shall conform to the methods, forms, mixture, placement, and curing for concrete as specified in Part 5 of these specifications, the Standard Details, and the Project Plans and Specifications.

   b. Any required reinforcement shall be of the kind, type, and size, and shall be located, spaced, bent, and fastened as shown in the Standard Details or the Project Plans. Concrete reinforcing in place shall be approved by the Director before any concrete is placed.

   c. All invert channels shall be accurately constructed and shaped so as to be smooth, uniform, give minimum resistance to flow and shall slope downward toward the outlet.

4. Precast Manholes and Appurtenances:

   a. Where precast concrete structures are permitted or required by the Project Plans, they will be manufactured in accordance with Part 2 of this Specification and to the sizes and shapes detailed in the drawings for this Specification.

   b. Precast manholes will require concentric cones in all cases. Flat slabs and eccentric cones will only be allowed with special permission.

   c. Joints for the precast manhole structures shall be formed with male and female ends so that when the manhole base, riser and top section are assembled, they will make a continuous, uniform manhole. The sealant between manhole sections shall be an elastomeric 0-ring joint conforming with ASTM C443, or it may be of a flexible rubber mastic sealant conforming to the requirements of AASHTO M-198B and SS-S-21 OA.

   d. The project plans shall indicate the required orientation of the precast concrete unit.

   e. When the precast units are delivered to the project site, damaged, cracked or imperfect sections will not be allowed to be installed unless approved by the City.

   f. No field modification will be allowed to the structure unless it is determined that such modifications will not adversely effect the strength of the structure.

g. After the excavation has been completed to the required dimensions specified on the detailed plan, the base shall be leveled off to receive the bottom section. If necessary, to provide a more level and solid foundation, a crushed limestone base may be required. The base must be set level so all water in the structure will drain toward the designed outlet.

h. Assemble the multi-section structure by lowering each section into the excavation, and firmly position one section on top of the other before backfilling.

i. The jointing material required shall be installed at the job site.

j. To insure joint integrity, give particular attention to removing all foreign materials, such as dirt, mud and stones, from the joint surfaces and see that all sealing materials are placed in accordance to the manufacturer's recommendation.

k. If a misalignment of sections occurs during installation, remove the upper section. If the sealing material is damaged, clean the joint surfaces before replacing new sealing material.

l. The allowable variance in vertical plumb is one foot in thirty vertical feet.

m. Backfill the precast structure as soon as practical.

n. The precast base of all structures shall require that the inlet and outlet openings be installed prior to delivery to the project site, except when installation has been approved on existing pipes.

o. All connections shall be by an approved patented compression type and will not be allowed through joints; therefore, the height of riser sections should be designed accordingly. The maximum percent grade and/or horizontal deflection for the use of “A-Lok” or “Z-Lok” connections are 12% (7º) and 46% (25º), respectively.

5. Inlet and Outlet Pipes: Inlet and outlet pipes shall extend through the walls of structures only a sufficient distance beyond the outside surface to allow for connections, and shall be cut off flush with the inside surface of the wall as shown in the Standard Details, on the Project Plans, or otherwise directed. Concrete or brick masonry or mortar shall be so placed around the pipes as to provide full continuous contact between masonry and outside of pipe, to prevent leakage, and to form a neat connection. Adequate water stops, approved by the Director, shall be used with all plastic pipe on all inlet and outlet pipes. The pipes for a precast manhole base shall be placed as an integral part of the base or the connections will be of an approved patented compression type joint.

6. Setting of Castings, Frames, Fittings and Steps:

a. All castings, frames, and fittings shall be placed in the positions shown in the Standard Details of Construction or Project Plans or as directed, and shall be set true to line and to correct elevation upon a full bed or mortar or 2 rows of 1 inch butyl rope to ensure a water-tight seal. If frames or fittings are to be bolted or anchored in concrete, all anchors or bolts shall be set and held in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has hardened to adequate strength.

b. When frames or fittings are to be placed upon previously constructed masonry, the bearing surface of masonry shall be brought true to line and grade to present an even bearing surface clean and free of debris particles. The unit shall be set in a full mortar bed as shown in the Standard Details of Construction or the Project Plans. All units shall be firmly and securely seated.

c. Frames and cover, or other similar pairs of items, shall have true common bearing surfaces such that the covers will seat firmly without rocking or shifting. The covers shall be placed after the frames or fittings have been installed and after the concrete or mortar has been allowed to harden for at least twenty-four hours and will not be damaged.

d. Steps shall be installed as shown in the Standard Details of Construction. When the steps are set in concrete, they shall be placed and secured in position before the concrete is placed. The steps shall not be disturbed or used until the concrete or mortar has set and cured for at least seven days.

Section H. TRENCH BACKFILL.

1. Placing of Backfill:

a. After the pipe or conduit has been properly bedded, jointed, and inspected, and all measurements to record location of Y-junctions, tees, etc. have been made by the City, and sufficient time has, elapsed for the joint materials or for any concrete or mortar to set and harden, upon permission of the Director, the backfill may be placed. All requirements of the agency of jurisdiction must be adhered to.

b. Backfill in trenches which are not within or immediately adjacent to pavements of concrete or pavements on stone or concrete base, and where granular backfill is not desired, shall consist of selected job-excavated earth thoroughly compacted with suitable mechanical tampers to the density of the adjacent undisturbed earth, or compacted to not less than 90 percent of maximum dry unit weight as determined by ASTM D698. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill material. Care shall be taken that stones and lumps are kept separated and well distributed, and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one inch in diameter with the upper six inches being free of all objectionable material. The approved backfill materials shall be placed in uniform layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 5 inches in loose depth for material compacted by hand-operated tampers.

c. If the trench is flooded before or during backfilling or subjected to conditions which might cause flotation of the pipe before sufficient backfill has been placed, the Contractor shall take the necessary precautions to prevent flotation of the pipe, conduit, or structure.

d. Before final acceptance of the work, additional tamped earth shall be added to restore settled trench surfaces to the required level of the adjacent earth surfaces

or the base or crushed rock wearing surfaces or to the finished earth base for sodding or for seeding. Where seeding or sodding are not required, the excess earth shall be uniformly and neatly mounded above the trench.

e. No separate payment will be made for compaction of trench backfill in unpaved areas, all costs of which are considered to be included in the bid prices for excavation.

2. Granular Backfill:

a. Backfill in trenches through pavements of concrete, or wearing surface on concrete or stone base, or brick, or macadam in highways, streets, rights-of-way, or wherever prevention of backfill settlement is considered essential, and where the Project Plans or Specifications require or the Director orders, shall be made with mechanically compacted granular fill from the level six inches above the top of the pipe to the subgrade elevation of the pavement, or to within 18 inches of finished grade where located in grassed areas.

b. Granular backfill shall consist of 3/4" minus crusher-run limestone (Type 3 – Backfill).

c. Place granular backfill material in layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 5 inches in loose depth for material compacted by hand-operated tampers. Granular backfill shall be compacted to not less than 98 percent of maximum dry unit weight as determined by ASTM D698.

Section I. PIPE SEWERS IN EARTH TUNNEL.

1. Construction Alternatives: Pipe Sewers in tunnel in earth shall be constructed where required by the Project Plans and in accordance with these Standard Specifications. If not prohibited on the Plans, and if otherwise practicable and desirable, the Contractor may request permission to construct this sewer in a bored hole, jacked liner, by the tunnel bore method, or by jacking. Considerations by the City for construction alternatives will include:

a. No additional costs to the City for the alternative construction method.

b. The Contractor shall be responsible for all cost of engineering review and design of the alternate method.

c. No additional time shall be added to the contract duration, as described in the contract documents.

2. Tunneling:

a. The Contractor shall carry out the work of tunneling and supporting the tunnel face, roof, walls, and floor so that there will be no fall or flow or caving or heaving of earth or other materials into the tunnel excavation, nor any other cause for endangering human life, or any public or private property above or adjacent to the tunnel. If there should be any fall or movement of earth into the tunnel at any time, the Contractor shall proceed with the work with all necessary precautions and in such a manner as will insure the safety of life and of all sewers, utilities

and public and private property above and adjacent to the tunnel. If any sewer or utility above or adjacent to the tunnel is endangered or has been damaged because of the tunneling operations or movements of earth, that utility shall be notified immediately and shall be given access to the work to carry out all necessary safeguards and repairs to such sewers or utilities. If any public or private property is endangered or has been damaged, it shall be repaired at the Contractor's expense. All cost and expense to the Contractor of carrying out the above requirements shall be considered to be included in his bid prices for the completed sewer in tunnel.

b. The Contractor shall make all excavations necessary for the construction of sewers in tunnel, whether in earth or partly in earth and in rock, shall furnish, place, and maintain all sheeting, bracing, lining or casing required to support the tunnel floor, roof, sides, and face until the pipe and its bedding, jointing, encasement, and backfilling has been completed. All liners shall remain in place. Methods are optional with the Contractor, provided the work can be carried out expeditiously, carefully, and in compliance with these specifications. Care shall 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 placed against it. No part of the lining, bracing, or flanges of steel liner plates shall project closer to the outside of the pipe or pipe bells than the clearance limits shown on the Project Plans, or a minimum of two inches, if not shown on the Plans. If timber is used for lining and bracing instead of steel liner plates, invert struts shall be placed at the required intervals but in such manner that the pipe and its bedding will be supported entirely by the original earth floor of the tunnel and not on timber lining or bracing. Timbering shall be so designed and placed that there will be no space or pockets that cannot be packed and filled. All excavated material not required for backfilling abandoned shafts shall be removed from the site and disposed of by the Contractor at his expense.

3. Shafts:

a. Shafts shall be constructed at the location shown on the Project Plans and in accordance with the Project Specifications. Temporary construction shafts shall be of adequate size and properly constructed and equipped to meet all requirements of safety to personnel and to the work. All shafts shall be fenced and properly guarded from the beginning of the excavation until the completion of the construction requiring the shaft.

b. Additional shafts, if requested by the Contractor, will not be allowed unless the Contractor secures additional access and unless the City approves the request in writing.

c. Provision shall be made at all shafts so that plumblines suspended on the centerline of the sewer at each end of the shaft will hang freely from the surface.

d. A substantially constructed ladder shall be provided in each shaft, and shall be kept in safe good repair, clean and clear of debris.

e. Lights, barricades, signs, and watchmen (when watchmen are required by the Project Plans or Specifications, or when ordered by the Director) shall be provided and maintained to properly protect the public, the workmen, and the work against injury.

4. Tunnel Plant: When necessary, requirements for power machinery and equipment within shafts and tunnels will be given in the Project Specifications.

5. Tunnel Drainage: The Contractor shall furnish and operate all necessary pumping equipment of ample capacity and make all necessary provisions to keep tunnels and shafts free of water during construction, and to satisfactorily dispose of such water. During placing of concrete, drainage and pumping shall be so arranged that concrete is placed in the dry and that no water will flow over the concrete until it has set and will not be damaged, and not sooner than two hours after initial set. The Contractor shall have on hand at all times sufficient equipment in good working order for all ordinary emergencies that are likely to arise.

6. Spaces Between Tunnel Excavation and Liner: Tunnel excavation shall be trimmed as nearly as practicable to exact line and grade and to such shape and size as will allow the construction of the sewer section as shown on the Project Plans. Cavities or spaces between the actual surfaces of excavation and the tunnel liner plates, whether from avoidable or unavoidable causes, shall be completely filled with a uniform sand-cement grout, consisting of one part Portland cement and seven parts sand and the minimum amount of water necessary for proper placing, placed under pressure through grout-hole nipples in the steel liner plates. The grout-holes shall be so located and the grout be placed in such sequence as to insure the complete filling of all cavities and spaces, and of carrying loads uniformly from the undisturbed material to the tunnel lining.

7. Pipe Laying: After the tunnel section is excavated and lined, the pipe shall be placed on and supported by steel rails or other approved supports. The supporting system shall assure line and grade and shall allow space below the pipe for concrete. Care shall be used to avoid damage to the pipe or to the liner plates. Any such damage shall be replaced when so directed by the Director.

8. Spaces Between Pipe and Tunnel Liner or Rock Surfaces: After laying the pipe, uniformly compacted or pumped Class "B" concrete shall be placed to fill all spaces between the outside of the pipe and inside surface of the lining or the prepared surface of the rock if the tunnel is in sound rock.

9. Removal of Temporary Shafts: Temporary shafts shall be completely abandoned. Unless otherwise specified on the Project Plans and Specifications, all sheeting, bracing, etc., may be removed or left in place at the Contractor's option. No payment will be made for sheeting, bracing, etc., left in place at the Contractor's option. If the Project Plans or Specifications require leaving the sheeting, bracing, etc., in place, payment will be made as provided in the Project Specifications. The shafts will be backfilled with approved material.

Section J. PIPE SEWERS INSTALLED BY TUNNEL BORE METHOD.

1. General: When permitted as an alternate method of construction by the Project Plans and Specifications or when permitted by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by the Tunnel Bore Method. When planning to use the

Tunnel Bore Method, the Contractor shall submit full detail of materials, equipment, and method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of the Tunnel Bore Method equipment, materials, and method to ensure that the work is installed as described in the contract documents, including construction within the time limits also described in the contract documents.

2. Equipment and Methods: Equipment and methods for the Tunnel Bore Method as proposed by the Contractor shall include:

   a. All applicable requirements of Section I, "Pipe Sewers in Earth Tunnel", in order to meet line and grade of the sewer as described in the contract documents.

   b. The Contractor shall provide all additional access and working room as may be required to accommodate the Contractor's method.

   c. The Contractor shall describe pipe repair procedures to be taken for damaged pipe, if damage should occur during installation.

   d. The Contractor shall provide the pipe joint design and any special care required for the application proposed.

   e. All utilities required to operate equipment for the tunnel bore method unless otherwise provided.

3. Material: Sewer pipe material and class will be as approved by the City.

4. Tunnel Bore Machine: The tunnel bore machine shall, as a minimum:

   a. Be capable of fully supporting the face both during excavation and shutdown.

   b. Be steerable and capable of controlling the advance of the heading to maintain line and grade.

   c. Be capable of supporting the surrounding excavated surfaces.

   d. Be capable of preventing soil and water infiltration between excavation at the face and the installation of the ground support system.

5. Tunnel Bore Lining: Tunnel lining shall be provided to support the surrounding excavation. The following materials are allowable:

   a. Steel liner plate.

   b. Ring beams and lagging.

   c. Carrier pipe of approved type, thickness or class. The carrier pipe must be of sufficient strength for use as a liner and for tunnel construction. The carrier pipe design must be reviewed and approved by a Registered Engineer at no cost to the City.

Section K. PIPE SEWERS IN ROCK TUNNEL.

Sewers in rock tunnel shall be constructed with a concrete lining only when required for the particular project. It shall be constructed in accordance with the Project Plans and Specifications and the applicable requirements of Parts 3, 4 and 5 of these Standard Specifications.

Section L. PIPE SEWERS IN STANKS.

1. Construction Requirements:

    a. Pipe sewers to be constructed in stanks shall be constructed of the size, type and class specified on the Project Plans and Specifications.

    b. Class C bedding shall be used and after placing the bedding the remaining space above the top of the pipe shall be packed solidly with tamped earth free from debris, rocks, lumps or organic matter or, at the election of the Contractor, with tamped limestone and screenings. The Contractor shall carry out the work of stanking in a safe prudent manner to avoid endangering human life or property.

Section M. PIPE SEWERS IN BORED HOLES.

1. Construction Requirements:

    a. When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted in writing by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed in bored holes. The boring machine to be used shall be in good mechanical condition and capable of drilling the bore hole within the required limits of accuracy. A smooth liner of sufficient strength shall 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. For gravity and force main sewers eight inches in diameter and larger the smooth liner shall be a minimum of two feet in diameter. The liner pipe shall be carefully inspected to insure that the carrier pipe can be properly placed. The pipe to be placed in the bore hole shall be ductile iron pipe of the required size and class. No plastic pipe shall be allowed. The mechanical or approved slip- joint connections between ductile iron pipe lengths shall be made carefully in accordance with the manufacturer's instructions. After placing the assembled pipe in the borehole, the ends shall be blocked to secure the proper flowline elevations at each end and to insure the placing of grout at the bottom and sides of the pipe. If necessary or required, a skid or shoe shall be provided for the pipe bell to permit flow or grout beneath the pipe, and to prevent sagging and pockets along the pipe flowline. The assembled and jointed pipe shall be placed in the borehole only by such method that will keep the joint in compression. Any method tending to unjoint the pipe while being placed will not be permitted.

    b. The spaces between the liner and the outside of the pipe shall be filled solidly with grout placed under mechanical pressure. Before placing grout, the carrier pipe shall be carefully inspected for uniformity of grade along its alignment, and any required corrections made. Particular attention shall be given to insuring that the pipe will be solidly supported by grout at its bottom and sides. The method of

injection under mechanical pressure shall be approved by the Director. Grout shall consist of an approved mix and it shall be placed by inserting the grout pipe to its greatest distance to insure filling all spaces, and then gradually withdrawing the pipe as filling proceeds.

c. Manholes at the ends of a section of sewer, part or all of which is constructed in a bored hole, shall not be constructed until the bored section is completed, in order to allow corrections for slight deviations in line and grade. The completed sewer constructed in a bored hole shall not deviate from its required alignment more than one percent of the total length of the bored hole, nor more than one-tenth foot from its required terminal elevation. If the deviations are greater than these, the construction shall be removed and replaced unless the Director, in writing, accepts and approves the actual construction as a result of a written request made by the Contractor for such acceptance and approval.

2. Abandoned Bored Hole:

a. When the Project Plans specifically state that the sewer be constructed in a bored hole, and unforeseen obstructions require abandonment of a partially completed borehole, and the starting of a new hole, the Contractor will be paid for his expense of drilling and backfilling such abandoned borehole by force account. It is required that complete detailed records be kept of time, labor, materials, and equipment on all work of boring each hole, whether completed or abandoned.

b. If the Contractor was permitted, or requested and obtained approval to use a bored hole in lieu of the method specified in the contract documents, but is not successful in completing the construction by the boring method, the Contractor shall receive no compensation for any expenses incurred by his unsuccessful attempt.

3. Use of Ductile Iron Pipe: When a section of ductile iron pipe adjoins a section of dissimilar sewer pipe without an intervening manhole, the method of joining will require approval by the Director prior to its construction. Care shall be used to insure alignment of the inside surfaces of the pipes and their flowlines.

Section N. PIPE SEWERS IN JACKED LINER.

When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by jacking a pipe as a liner and inserting a carrier pipe of required size, type and class. When planning to use jacking for liners, the Contractor shall state in writing the kind, type and strength of liner, the type of joint proposed and the method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of his jacking operation equipment and materials.

Section 0. SEWERS INSTALLED BY JACKING.

When permitted as an alternate method of construction by the Project Plans and Specifications, or when permitted in writing by the Director upon written request by the Contractor in substitution for the method of construction shown on the Plans, pipe sewers may be constructed by jacking. When planning to use jacking, the Contractor shall submit full details of materials

and method of operation. Approval in writing by the Director shall be obtained in advance of starting the work. In any case, the Contractor shall retain full responsibility for the adequacy of his jacking operations equipment and materials.

Section P. GROUTING.

1. General: When required by the Project Plans and Specifications or by the Standard Details and Specifications, or when ordered by the Director, grouting shall be done by the Contractor. Grout may be required to set anchors or dowels in holes drilled in rock or concrete, to fill spaces between excavated tunnel surfaces and linings of tunnels or bored holes, or voids in packed rock, etc.

2. Mixtures: Grout shall consist of a uniform mixture of Portland cement and sand, as specified for a particular purpose, either in these Specifications or in the Project Specifications, and with the minimum volume of water as may be found necessary to accomplish the intended result. If ordered by the Director, neat cement grout shall be used. The use of special cements or admixtures for particular uses will be specified in the Project Specifications, if required.

3. Grouting Requirement and Application:

    a. All grouting equipment and appurtenances shall be in good mechanical working condition, of an approved type of design with ease of control to permit uniform operation without excessive pressures, and with adequate capacity to permit continuous satisfactory progress in the required grouting. Grout for filling voids or spaces shall be applied through a pipe or hose in a continuous operation without disturbance of grout which has taken initial set. The grouting operation and sequence shall be so conducted as to insure complete filling of voids or spaces and shall be sufficient to fill all spaces without distorting or damaging the structure, or without lifting or distorting the adjacent or overlying confining materials.

    b. Grouting for filling voids and connecting surface irregularities in mass crushed-rock, rip-rap, or similar paving is described in Part 5.

    c. Special grout mixes will be considered for use by the Director at the time of construction.

Section Q. METHODS OF MEASUREMENT AND BASIS OF PAYMENT.

1. General:

    a. Payment will be made for the materials furnished and completed work done under the contract as stated herein in accordance with actual measurements. The Contractor shall not be entitled to receive additional compensation for anything furnished or work done, except for extra work authorized by written order of the Director, or for which provision has been made in the Project Plans or Project Specifications which will state the method of measurement and basis of payment for any item of construction not covered by this section of the Standard Specifications.

    b. It is the intent of these specifications to pay only once for any given item of work or material to be furnished, except where it is clearly specified as an addition to

the bid price for the unit quantity. Duplication of quantities, units, or bid items will not be permitted, even though the Project Plans or Specifications may, through error or oversight, allow such duplication.

2. Pipe Sewers: Payment will be made for completed pipe sewers, round or elliptical, for each size, kind, and class of pipe laid at the respective bid price per lineal foot. The length for which payment will be made will be the measured horizontal distance for each along the centerline of the pipe exclusive of the distance between the inside faces of each connected structure, sewer, manhole, inlet-manhole, inlet, junction chamber, transition section, or other similar structures. The payments made shall include all costs of labor, materials, tools, and equipment, and shall be full payment for furnishing and installing pipe, jointing materials, crushed limestone in replacement of overdig, and furnishing, placing, and compacting the bedding.

3. Curved or Radius Pipe: Unless otherwise provided in the Project Specifications, no additional payment will be made for curved or radius pipe which shall be measured and paid for in the same manner as described for straight pipe. Any additional costs for curved or radius pipe shall be included in the bid price per lineal foot for pipe of the size, kind, and class involved.

4. Tees, Wyes, Bends, Stubs, Etc.: Payment will be made for tees, wyes, bends, stubs, slants, and other specials where required by the Project Plans and Specifications or where ordered by the Director, at the bid price for each and as an addition to the amount paid for the completed pipe sewer containing such special, except where the cost of a special is included in the lump sum bid price for a given bid item. The payment for the special shall include furnishing and installing of an approved stopper, cap or cover.

5. Concrete for Encasement:

    a. Payment will be made for Class “A” concrete in encasements at the bid price per cubic yard for the class of concrete used. The quantity for which payment will be made will be the respective quantity per lineal foot for each size pipe as tabulated in the Standard Details and for the actual length of sewer so encased.

    b. Such payment shall include the entire cost of furnishing and placing the concrete cradle or encasement as shown in the Standard Details. It also shall include the costs of the necessary excavation beyond paylines and also the cost of supporting and securing the jointed pipe against movement during the placing of the concrete.

6. Manholes:

    a. Payment will be made for each manhole on pipe sewers twenty-four inches in diameter and smaller at the bid price per lineal foot for completed standard manhole construction for the vertical distance between the elevation of the top of the cast iron frame and the average elevation of the flowline at the manhole center. Such payment shall include all costs of the manhole base, invert, walls, making pipe connections, and steps, frames and covers; but exclude payment for lumber ordered left in trench, and excavation.

    b. Payment will be made for each manhole on pipe sewers twenty-seven inches in diameter and larger at the bid price per lineal foot for completed standard manhole construction for the vertical distance between the elevation of the top of

the cast iron frame and the elevation for the top of the bottom section of manhole. Such payment shall include all costs of such manhole construction, steps, frame and cover, and making pipe connections; but exclude payments for lumber ordered left in trench, excavation, and the bottom section of manhole.

c. The bottom section of manhole shall include all construction below that elevation determined by the sum of the average elevation of the flowline at the manhole center and one of the following: Inside vertical dimension of outlet pipe + 12 inches for pipes with vertical dimensions 27 inches through 51 inches. Inside vertical dimension of outlet pipe + 18 inches for pipes with vertical dimensions 54 inches through 72 inches. Inside vertical dimension of outlet pipe + 24 inches for pipes with vertical dimensions 75 inches through 96 inches.

d. Payment for the bottom section of manhole shall include all costs of such construction, including the base, invert, walls, manhole steps, and making pipe connections, but exclude payments for lumber ordered left in trench, and excavation.

e. Payment will be made for completed foulwater drop construction as an addition to the payment made for the completed manhole. Such payment will be made at the lump sum bid price of each location or for the designated location, and shall include all costs of excavation, lumber left in trench, concrete or brick masonry, drop pipe, pipe elbow, jointing, and the additional cost of the pipe junction on the sewer and its concrete encasement.

7. Junction Chambers: Payment will be made for each junction chamber completed as required by the Project Plans and Specifications at the lump sum bid price for constructing the junction chamber. Such payment shall include all cost of masonry, forms, concrete, reinforcing steel, steps, manhole construction above the top of the chamber, and making pipe connections; but exclude payments for lumber ordered left in trench, excavation, and granular fill.

8. Trench Backfill:

a. No separate payment will be made for the placing of mechanically-compacted backfill in the trench, unless granular backfill is required or ordered by the Director. All such costs shall be included in the bid prices for excavation.

9. Backfill Around Structures:

a. No separate payment will be made for mechanically-compacted backfill around manholes, junction chambers, and other structures unless granular backfill is required or ordered by the Director. For manholes, the volume for which payment will be made for granular backfill shall be that of a prism bounded by vertical planes or surfaces six inches from and parallel with the outermost lines of the structure, and a height equal to the average distance between the original ground surface, subgrade of replacement pavement base, or the elevation shown on the Project Plans or ordered by the Director, and the subgrade for the structure, less the computed gross volume of the structure. For junction chambers or other special structures requiring form work, the volume for which payment will be made for granular backfill shall be that of a prism bounded by vertical planes or surfaces twelve inches from and parallel with the outermost

lines of the structure and an average height computed as described immediately above for manholes, etc., less the computed gross volume of the structure.

b. Payment for the computed quantity of granular backfill for manholes, junction chambers, or other structures will be made at the respective bid price per cubic yard for “Granular Backfill”.

10. Pipe Sewers in Earth Tunnel:

a. Payment will be made for the construction of completed pipe sewers in earth tunnel at the respective bid price for each size and type per lineal foot for Completed Sewer in Earth Tunnel. The length for which payment will be made will be the measured horizontal distance along the centerline of the sewer to the paylines of excavation for shafts or to the portal of the tunnel excavation. The payments made shall include all cost of shafts, headings, liner plates, timbering, grouting, drainage, lighting, ventilation, all Class C excavation, pipe in place, concrete, reinforcing, masonry, bedding, cradling or encasing, backfilling tunnel and any additional costs required to construct the completed pipe sewer in tunnel in earth. If Class B excavation is encountered in earth tunnel, payment will be made at the actual volume of Class B excavation removed within limits, which shall not extend more than twelve inches on either side of the pipe bell or the diameter of the tunnel liner, whichever is smaller. The minimum volume paid will be that of a four foot diameter casing pipe. Payment will be made at the bid price for Class B excavation in Earth Tunnel and will be an additional payment to the payment made for completed sewer in earth tunnel.

b. If Class A excavation is encountered in Earth Tunnel, payment will be made for the actual volume of Class A excavation removed within the same limits as set for Class B excavation. Payment will be made at the bid price for Class A excavation in Earth Tunnel or, in absence of a bid price or an agreed price, by force accounts and will be an additional payment to the payment made for Completed Sewer in Earth Tunnel.

11. Pipe Sewers Installed by Tunnel Bore Method: Payment will be made for the construction of completed pipe sewers installed by the "tunnel bore method" by the same method outlined for the payment of pipe sewers in earth tunnel, as delineated in these Specifications.

12. Pipe Sewers in Bored Holes:

a. Payment for completed pipe sewer in a bored hole, when required or permitted as an alternate to pipe sewer in tunnel shall be made at the bid price for the construction method specified and for the length constructed in a bored hole. When permitted as an alternate to open-cut construction, payment will be as if the sewer has been constructed in open-cut with payment for Class C excavation, for the type and class of pipe originally specified, with allowance for pavement to be removed and replaced, and for required granular or compacted backfill. There will be no payment for the additional cost of the pipe and its encasement, and no allowance for lumber left in trench. Permission to use construction involving a bored hole and ductile iron pipe instead of the construction originally specified shall not entitle the Contractor to any compensation for costs of an unsuccessful or an incomplete attempt to use a bored hole. Any excavated material removed by an earth boring auger will be

considered Class C for payment purposes other than material that has been identified as Class A excavation.

b. Payment for completed pipe sewer in a bored hole where specified by the Project Plans and Specifications, or where ordered by the Director, shall be made at the bid price per lineal foot of completed specified sewer constructed in a bored hole. The length of sewer for which payment will be made shall be the measured horizontal distance along the centerline of the pipe between the faces of the bore limited to the length required by the Project Plans and Specifications, unless such length has been ordered increased by the Director. Such payment shall cover all costs of labor, materials, equipment and tools to prepare the boring pit, bore the hole, install the liner pipe, lay and joint the ductile iron pipe, provide concrete collars at the junctions with other types of pipe, completely fill the annular space around the pipe, backfill the boring pit, and do all other things necessary or required for constructing the completed pipe sewer in a bored hole.

13. Pipe Sewers in Jacked Liners: Payment for completed pipe sewer in a jacked liner, where permitted by the Project Plans and Specifications as an alternate to a pipe sewer in tunnel in earth, shall be made at the bid price for the construction method originally specified. Permission to use construction involving a jacked liner shall not entitle the Contractor to any compensation for any additional expenses or for the costs of an unsuccessful or incomplete attempt to use jacking. When permitted as an alternate to en-cut construction, the method shall be approved by the Director.

14. Pipe Sewers Installed by Jacking: Payment for the construction of pipe sewers installed by jacking at the approved request of the Contractor as an alternate to tunneling will be made at the bid price for the given size of specified pipe sewer in tunnel, unless an agreed price has been established. The length of sewer for which payment will be made shall be the measured horizontal distance along the centerline of the pipe between the ends of the completed pipe sewer jacked into final position, limited to the length which shall not exceed the distance between tunnel faces. Such payment shall cover all cost of labor, materials, equipment and tools for the jacking pit, guides, and jacks; drainage and excavation; furnishing, jointing, and jacking the pipes; and doing all things necessary to construct the completed pipe sewer by jacking. Permission to install a pipe sewer by jacking instead of the construction originally specified, shall not entitle the Contractor to any compensation for any additional expenses or for the costs of an unsuccessful or an incomplete attempt to use jacking.

15. Grouting: Unless otherwise provided by the Project Plans and Specifications, no separate payment will be made for grouting. Any costs of furnishing and placing grout as required by the specifications for any specific item shall be considered to be included in the payments made for such item or items. Payment shall include all costs of mechanical compaction of the granular backfill, with maximum lifts of 12 inches.

16. Granular Backfill:

a. Payment will be made for granular backfill at the bid price per cubic yard for "Granular Backfill" for the computed volume measured in place after final compacting. Payment shall include all costs of mechanical compaction of the granular backfill.

b. The volume of compacted granular fill for each sewer will be based on a square-bottomed trench with vertical sides a distance apart equal to the payline

trench width; a length equal to the measured horizontal distance between vertical planes representing the average ends of the granular fill as placed in the trench, or to the payline limits of an intermediate structure as shown on the Project Plans or as required; and a depth to the average vertical distance measured along the centerline of the sewer at twenty-five foot intervals between the elevation either six-inches above the top of the pipe or at the top of concrete encasement, and either the bottom of the pavement base or the elevation to which granular fill is required on the Project Plans ordered by the Director. The volume of compacted granular fill surrounding manholes, inlet-manholes, inlets and catch basins, of junction chambers and special structures requiring form work will be computed separately.

c. The cost of any additional granular fill required beyond payline limits due to unauthorized excavation beyond payline limits is to be borne by the Contractor.

PART 5 - CONCRETE CONSTRUCTION

Section A. GENERAL.

Concrete shall be composed of Portland cement, fine and coarse aggregates and water, all properly proportioned by weight, thoroughly mixed, and of proper consistency. An air-entraining agent or an admixture, uniformly dispersed through the concrete during mixing, shall be added only when specifically required in Part 5, the Standard Details, the Project Specifications, or for appropriate special structures by the Director.

Section B. MATERIALS.

Materials for concrete shall conform to the pertinent paragraphs in Part 2 of these specifications. In general, only one source and kind of material conforming to these specifications shall be used throughout the work of constructing each complete unit of the particular contract. Previous to beginning the work, the Director shall be informed of the kind and source of materials to be used. When reference is made to a material, it is intended to relate only to the kind and source of material, washed gravel, crushed limestone, Mississippi or Missouri River sand, or Meramec River sand, and not to its grading requirements. All fine and coarse aggregate must be stored separately and shall be kept clean and free from contamination. The mixing of materials from different sources will not be permitted. In no case shall frozen lumps or partially cemented materials be used.

Section C. CLASSES OF CONCRETE.

1. General:

   a. Concrete will be designated by classes. These Standard Specifications and the Standard Details will state which class and type of cement is to be used for each structure, except where otherwise required in the Project Plans and Specifications. Type I cement normally will be used, except for sanitary sewer construction for which Type II cement shall be used. The following table shows the classes of concrete, the minimum cement content per cubic yard, and the maximum water content per sack of cement, including free moisture in the aggregates. Class "A" concrete is required unless otherwise stated.

CONCRETE		
Class	PORTLAND CEMENT (Sacks) Per Cubic Yard	MAXIMUM WATER (including Free Moisture in Aggregates) Gallons Per Sack
A	6	6 ½
B	4	8 ½
C	2	9 ½

   b. If the Contractor desires to add more water to a given class of concrete than is permitted by the table in order to facilitate placing, and the Contractor is given permission to do so, the Contractor must maintain the same water-cement ratio as shown in the table by adding proportionally additional cement. The minimum compression strength for Class A Concrete shall be 3,500 psi at 28 days.

2. Proportioning:

   a. The proportions of materials shall be such as to produce a concrete of the required strength that can be placed easily into the corners and angles of forms and around reinforcements with the method of placing used in the work, and without separation or segregation of the materials or collection of free water on the concrete surface.

   b. All materials shall be proportioned by weight. The quantities of fine and coarse aggregates for each batch shall be exactly sufficient for one or more sacks of cement. No batching requiring fractional sacks of cement will be permitted. Proportioning by volume will be allowed only with permission during emergencies and for a total volume less than one cubic yard.

   c. Prior to the start of a construction project the concrete mix design intended to be used shall be submitted to the Director for approval.

3. Admixtures: No admixture shall be used without the permission of the Director. Whether specified or permitted by request, previous approval shall be obtained for the admixture to be used. Air-entraining admixtures shall conform to the requirements of Part 2. When an admixture is to be used, a dispenser capable of accurately measuring and adding the required amount of admixtures to the batch at the beginning of the mixing period shall be provided at the mixer. The minimum required compression strength and durability shall not be reduced or compromised by any admixture.

4. Air-entrained Concrete:

   a. All concrete for use in special structures shall be air-entrained.

   b. When air-entrained concrete is specified, the freshly mixed concrete shall contain the following amounts of entrained air when measured by the volumetric method ASTM C173, or by the pressure method ASTM C231.

AIR CONTENT BY VOLUME		
MAXIMUM SIZE OF COARSE AGGREGATE	MAXIMUM %	MINIMUM %
1 ½", 2" or 2 ½"	6	4
¾" or 1"	7	5
3/8" or ½"	8 ½	6 ½

   c. Mixes should be designed for the recommended air content and adequate control provided to keep air content within required limits. The Contractor shall maintain close control over the uniformity of the concrete, and over the cement, aggregates, water content, consistency, operation and accuracy of proportioning, mixing time, and operating equipment, until finally placed in the forms.

   d. Air entrainment shall be obtained by the use of an approved air-entraining agent added in the quantity required to obtain an air content within the specified limits. All air-entraining agents shall be added to the concrete during the process of mixing. The agent shall be accurately measured and dispensed by means of an approved mechanical dispenser, which will automatically and gradually discharge the required amount of material into the stream of mixing water before all of the mixing water has entered the mixer drum.

5. Consistency:

a. The consistency of the concrete shall be such that the slump, when measured according to ASTM C143 is the least compatible with workability and ease of placing. In general, the slump tested at the placement site shall meet the following requirements:

REQUIRED SLUMP	
KIND OF WORK	INCHES
Paving	4
Reinforced Concrete Structure	4 ± ½
Unreinforced Structure	3 ± ½
Tremie-placed Concrete	7 ± 1

b. Additional water shall not be added at the site except with permission and under strict supervision of the Director, and then only in an emergency. Such additional water shall be added only in small increments and then only in the smallest amount necessary within the required limits of consistency for the particular work, and shall be uniformly mixed and incorporated into the unplaced concrete before deposition in the forms.

Section D. BATCHING AND MIXING.

1. Plant-mixed or Ready-mixed Concrete:

a. Along with its preparation, it shall conform to the requirements of Standard Specifications for Ready-mixed Concrete ASTM C94 and these specifications. All scales and measuring equipment shall be regularly tested and approved by the Inspector of Weights and Measures of the State of Missouri, and as often thereafter as may be required by the Director. Concrete plants shall be open to inspection by the Director and his duly authorized agents at any reasonable time that may be necessary and also during the time while furnishing concrete to any City project. All batching, mixing, and approved delivery equipment shall be maintained in good condition, adjustment, and operation. Batching of aggregate from bins where the aggregates come directly from the screening plant or washer, or in which the aggregate may segregate, shall not be permitted. Any batch of concrete which does not meet the requirements of these specifications shall be rejected and replaced with acceptable concrete at the expense of the Contractor whether at the plant or delivered at the site of work.

b. The concrete shall be mixed until all materials are uniformly distributed within the mixture, and for a period not less than one minute after all materials are in the mixer drum, when the drum is revolving at the speed for which it was designed. No materials for a batch of concrete shall be placed in the drum until all of the previous batch has been discharged therefrom. The water shall be added at the time the materials are being run into the mixer.

c. During construction, test cylinders shall be taken at the discretion of the Director. The Director shall be responsible for the cost of testing.

2. Handmixing:

a. Handmixing of concrete shall not be permitted except in case of an emergency.

b. If handmixing is permitted, it shall be done on an impervious surface, such as a concrete pavement, using the same proportions with the addition of one extra sack of cement for each cubic yard of concrete mixed. The sand and cement shall be mixed dry until the mixture shows an even color throughout. The mixture shall be spread to a depth of eight inches on the mixing board, and the coarse aggregate then be spread to an even depth over it. The combined mixture shall then be cut through, turned and mixed with square-end shovels. Water shall be added from time to time and mixing continued until all materials are uniformly distributed throughout the mixture. Excess water shall be avoided in order to meet the requirements of the slump test. Aggregates and water shall be accurately measured.

Section E. CONVEYING AND PLACING.

1. Standard Practice:

a. The standard practice for conveying and placing concrete as outlined by the American Concrete Institute shall be followed. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent separation or loss of materials and contamination due to debris, dirt, or any foreign material. The maximum height of an unconfined drop of concrete shall be six feet. Equipment used shall be suitable and in good clean mechanical condition. Approved equipment for placing concrete by pumping shall be used when gravity methods become impractical or difficult. Before placing concrete in the forms or in the place of deposit, all debris and foreign materials, soft earth, mud, and water shall be removed. No concrete shall be placed in water unless entirely unavoidable, and then only with permission and approval of such method of placing that will prevent washing and dilution of the concrete. Steel or wood forms shall be oiled and treated to prevent adhesion of concrete and damage to the concrete surface upon removal of the forms. Concrete shall be placed as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the forms and around reinforcing. No concrete shall be used that has partially hardened or has been contaminated by foreign material or that has been retempered.

b. When concreting has once started, it shall be carried on as a continuous operation until the section or structural unit is completed. The top surface shall be leveled or screeded or finished to the shape, level, and type of finish required by the Project Plans or Specifications and Standard Details. When construction joints are required, they shall be made in conformance with Part 5. Care must be used to avoid displacing or disturbing the reinforcing steel.

c. All concrete shall be thoroughly compacted by vibrators, spading, or other suitable means during the operation of placing to insure that concrete will flow around all reinforcement, embedded fixtures and into the corners and against the surfaces of the forms to give a dense finished product with true surfaces free from honey-combing and other imperfections.

d. Concrete, when delivered to the project, shall be subjected to reinspection and acceptance or rejection after its arrival.

e. No more concrete shall be delivered to the project than can be readily placed. All delivery tickets from the concrete shall be machine stamped with time of batch. All concrete not in place 90 minutes from batch time shall be subject to rejection

Section F. MORTAR AND GROUT.

1. Mortar Mixture For Sewer Construction:

   a. Mortar for sewer construction shall consist of a uniform mixture of Portland cement and sand with the minimum amount of water to produce the required consistency for the particular required use. No admixtures shall be used without the permission of the Director. All materials shall conform to the requirements specified in Part 2.

   b. Mortar shall be prepared in suitable mixing equipment or, for small amounts, on a hard impervious surface. It shall be kept free from contamination, debris, or other deleterious substances until incorporated in the construction. Retempered mortar or partially set mortar shall not be used.

2. Mortar For Other Purposes: Mortar for brick masonry is described in Part 4. Mortar for building or architectural purposes, or for special uses, will be described in the Project Specifications or on the Project Plans for such work.

3. Grout:

   a. Grout will be described in the Project Specifications or on the Project Plans or in the Standard Details with the item for which it is used. Retempered grout shall not be used. Grout shall be kept in a uniformly mixed condition during placing.

   b. Grout for filling the voids in grouted rip-rap, revetment, or rock surfacing shall consist of an eight sack mix of Portland cement per cubic yard with the minimum amount of water required to permit the grout to flow into the spaces. An approved air-entrainment agent shall be added to the grout. No separate payment will be made for mortar or for grout. Its costs are included in the various bid items requiring its use.

   c. Special grout mixes will be considered for use by the Director at the time of construction.

Section G. CONSTRUCTION JOINTS.

1. Construction Joints:

   a. The placing of concrete shall be so planned that construction joints may be made where shown on the Standard Details or on the Project Plans, or where approved by the Director, and be so located and constructed as to impair the structure as little as possible. Additional reinforcement shall be provided at construction joints as required by the Project Plans and Specifications, and as directed. A structural key shall be provided as shown on the Project Plans or as directed. For a horizontal key, concrete shall be left with a roughened surface. Before concrete

is to be placed against any keyed joint, its surface shall be cleaned and all laitance removed. Immediately before placing the new concrete, the surface of the joint shall be thoroughly coated with neat cement grout. Concrete in walls and columns shall be placed continuously from the base to the bottom of the slab or slab and beam construction. After placing concrete in columns or walls, at least two hours shall elapse before placing the concrete for the slabs or beams and slabs.

b. Column caps, haunches, and corner fillets shall be considered as a part of the slab or floor construction and shall be placed integrally therewith. Joints in slabs shall be parallel and midway between the main reinforcing. Joints in slab and beam construction shall be located near the middle of the span of slab, beams, or girders. If a beam intersects a girder, the joint in the girder shall be offset a distance twice the width of the beam.

Section H. FINISHING.

1. General: Immediately after removing the forms, all fins or irregular projections shall be removed from all surfaces except those in contact with backfill and which are not to be exposed. All construction or special joints in the completed work shall be carefully tooled and be free of all mortar and concrete. On all surfaces, cavities produced by form ties, holes, honeycomb areas, broken edges or corners, and other surface defects shall be cleaned, and carefully filled, pointed and troweled to a true uniform smooth surface with sand-cement mortar mixed in the proportions used in the grade of concrete being finished. Such repaired surfaces shall be kept moist for a period of twenty-four hours.

2. Rubbed Surface Finish: Rubbed surface finish will not be required unless specifically required by the Project Plans and Specifications, except in the case of repaired surfaces where the uniform finished appearance of the exposed surface is important. Rubbing will not be permitted until the repaired surface has set for at least twenty-four hours. The final finish shall be attained by rubbing the repaired area and adjacent surface with a carborundum stone and water until the entire surface is of smooth uniform texture and color matching the adjoining surface. After rubbing is completed, any remaining paste, powder, or objectionable evidence of repair shall be completely removed.

Section I. CURING AND PROTECTION.

1. General: Provisions shall be made for protecting concrete, brick masonry, and cement plastering against damage from freezing or from lack of moisture. All concrete placed into the forms shall have a temperature between 50 and 90 degrees F. The Contractor will be responsible for all damage to the concrete surface due to the flow of water over uncured concrete, vandalism, etc. Unless otherwise provided in the Project Specifications, the cost of curing and protection are included in the payments made for the bid items of construction requiring the use of curing and protection for cement and concrete work.

2. Cold Weather: All job-stored materials shall be covered and protected from ice and snow. The temperature of mixing water shall not be less than 55 degrees F nor more than 165 degrees F. All reinforcement, forms, fill material and ground which the concrete will contact shall be free of frost or ice and snow. Whenever the temperature of the surrounding air is 40 degrees F and falling, no concrete shall be placed unless the Contractor has on hand sufficient, suitable, and approved means of protecting the concrete. The subgrade of any structures on which concrete is to be placed shall be

adequately protected, if necessary, to prevent freezing prior to placing. Whenever the temperature of the surrounding air is below 40 degrees F adequate means shall be provided for maintaining a temperature in the surrounding air of not less than 70 degrees F for as much time as necessary to insure proper curing of the concrete. The housing, covering, or other protection used shall remain intact and in place at least twenty-four hours. If the structure is backfilled the next day, the backfill will be considered adequate protection in lieu of the housing or covering that is initially required. Salt or chemicals shall not be used to prevent freezing. Whenever the temperature of the surrounding air reaches 32 degrees F and lower, concrete shall not be placed except with approval of the Director, who shall state the time in addition to that specified herein that artificial heat and protection must be supplied. Whenever the temperature of the surrounding air reaches 20 degrees F or lower, no concrete shall be placed except for emergencies and only with permission of the Director.

3. Hot Dry Weather: Provision must be made to protect concrete, brick masonry, and cement plastering from drying, and to maintain a moist condition for curing for at least five days after placing of concrete and at least two days after laying and plastering brick masonry. For high-early-strength concrete, moist curing shall be provided for at least two days after placing. Plastering on the outside of manholes and the top and side surfaces of monolithic sewers may be cured by use of approved curing compounds uniformly sprayed as recommended by the manufacturer.

Section J. CONCRETE FORMS.

1. Forms:

   a. Forms shall conform to the shape, lines, dimensions, and elevations of the structures shown on the Project Plans or the Standard Details. They shall be substantial and tight to prevent the leakage of mortar. Be of adequate strength and properly braced to rigidly maintain their shape, position, and elevation under all loading conditions. Forms for exposed surfaces such as the interior of sewers, faces of headwalls and architectural concrete shall produce a smooth regular true surface without offset, joint marks or surface blemishes. Joints shall be buff joints. Forms and centering shall be designed to allow their removal without damage to the structure. Forms for walls of rectangular section sewers on curves shall be laid to a true curve using a maximum of two feet form sections and they shall be plumbed and constructed in a manner so that they are uniform and in proper alignment. Inside exposed edges of walls, and edges next to expansion joints in walls shall be chamfered 3/4 inch. Other exposed corners and edges next to expansion joints shall be properly tooled.

   b. Wood spreaders shall not be used: Only metal form ties and spreaders with removable heads shall be used, so that, upon removal of forms, exposed metal ends can be covered with at least one inch cement mortar.

   c. Concrete in walls to be placed against rock excavation may be placed against the rock without back forms, provided care and precautions are taken to prevent the contamination of the placed concrete due to falling earth and other debris. Back forms must be provided for walls to be placed against earth excavation. Loose earth likely to fall into the forms must be stripped back, and precautions taken to prevent contamination of the placed concrete. In cases where circumstances require placing of concrete against vertical earth excavation for

walls, similar precautions must be taken, and the earth surface stabilized with sprayed asphalt emulsion.

d. Forms and supporting forms or shoring shall not be removed until the concrete has attained sufficient strength to permit removal without injury to the concrete or to the strength of the construction, and able to support safely its own weight and the load upon the construction. Forms for arches shall not be slackened until the concrete has attained a compressive strength of fifteen hundred pounds per square inch as determined from cylinders cast at the time of placing the arch concrete, and stored and cured under similar conditions as the concrete in the sewer arch. Supporting forms for all beams or slabs shall remain in place for a minimum of seven days. Supporting shores may be required after removal of forms. The Contractor shall be responsible for all damage due to premature removal of forms. Forms shall be cleaned and oiled upon removal. Defects in the exposed surfaces of the concrete shall be repaired.

Section K. REINFORCING STEEL.

1. General Requirements:

a. All reinforcing steel shall conform to the requirements of Part 2. The Contractor shall provide shop drawings for bending and placing, and a bar list of furnished reinforcing and accessories. With the Director's permission, Grade 40 steel will be allowed to be field bent, one time only. The steel shall be cold bent around an appropriate template. All other grades of steel shall not be field bent.

b. Steel reinforcing bars shall be of the sizes and be accurately placed, spaced, and located as shown on the details of the Project Plans or Standard Details. Bars shall not be spliced except where shown on the plans or permitted by the Director.

c. Use of bar-splices at locations of maximum stress shall be avoided, and if unavoidable, shall develop the full strength of the bar. The length of splice for main stressed bars shall be not less than 30 diameters; and for non-stress or temperature bars, shall be not less than 20 diameters. In case that the plans do not show the required thickness of concrete cover for reinforcement in sewer construction, the required concrete thickness shall be as follows: three inches at bottom and sides of footings and slabs in contact with earth, two inches in formed walls and at inside face of sewers.

d. Exposed reinforcement or dowels for bonding future extensions shall be protected from corrosion by concrete or other adequate covering. Bars shall be securely wired and held in position by approved chairs and spacers. When use of chairs is impractical, approved concrete supports may be used. The methods used must be such that reinforcing cannot be disturbed or moved from the required position during placing of the concrete.

e. Reinforcing steel shall be free of mud, mill scale, rust, paint, oil, or other deleterious coating. No reinforcing shall be set in a muddy or wet excavation. Reinforcing shall be inspected and approved by the Director before any concrete is placed.

PART 6 - MISCELLANEOUS

Section A. GENERAL.

Requirements for items of construction not previously described in the preceding Parts are set forth in this Part.

Section B. CONNECTIONS TO EXISTING FACILITIES.

1. General:

    a. New pipe sewers shall be connected to existing sewers at existing manholes, or at locations requiring the construction of a new manhole on the existing sewer, or directly to a sewer normally requiring no manhole, unless otherwise shown on the Project Plans.

    b. The Contractor shall verify the exact location and elevation of existing sewers immediately prior to actual construction. Any differences should then be brought to the attention of the City.

2. Existing Manholes:

    a. If a bulkhead opening of adequate size or a stub of proper size, elevation, location, and direction exists at the manhole, the pipe connection will be made as required for pipe laying. The cost of removing the bulkheads and making the pipe connection is included in the cost of laying the new pipe sewer. If the existing stub is not suitable for use, or if no stub exists, a new connection must be made to the manhole. The stub shall be removed or a hole shall be cut in the manhole wall to permit inserting the pipe at the required flowline elevation, horizontal angle, and slope, and to allow two inches of space around the pipe for bedding and filling solidly with 1:3 cement:sand mortar. Care shall be used to avoid unnecessary damage to the existing structure. Any damage caused by the Contractor shall be repaired to the satisfaction of the City. All loose material shall be removed from the cut surfaces, which shall be completely coated with mortar before setting the pipe. Before inserting the pipe, a sufficient thickness of mortar shall be placed at the bottom and sides of the opening for proper bedding of the pipe. After setting, all spaces around the pipe shall be solidly filled with mortar, and neatly pointed up on the inside to present a smooth joint, flush with the inner wall surface. Any necessary revisions in the existing invert shall be made to provide a smooth plastered surface for properly channeled drainage from the new connection. Particular care shall be given to insure that the earth sub-base and bedding adjacent to the manhole will provide firm solid support to the pipe.

    b. Payment will be made for the costs of properly handling all existing flows, cutting a hole in the existing manhole, adjusting the invert, and making a completed pipe connection at the bid price for making a pipe connection to an existing manhole. New connections at levels above the manhole flowline for inlet lines will be made similarly except for the requirements of invert adjustment, unless otherwise required in the Project Plans and Specifications. Payment will be made at the bid price for making a pipe connection to an existing manhole.

3. Existing Sewers:

   a. Connections to existing sewers shall be made as shown in the Standard Details or as modified in the Project Plans. Care shall be used to avoid damage to the adjacent sewer walls or masonry. The opening shall be of sufficient size to permit inserting the pipe at the required flowline elevation, horizontal angle and slope, and to allow at least two inches of space around the pipe for bedding and filling solidly with 1:3 cement:sand mortar. If there are reinforcing bars in the sewer walls, only those preventing insertion of the pipe may be cut. All others shall be bent into the Class A concrete collar at the junction of the connection pipe and the existing sewer. Unless a detail is provided, the collar shall have vertical walls not less than six inches thick above, below, and at the sides of the connecting pipe, and at least twelve inches from the outside of the existing sewer at the spring line of the connecting pipe. The bottom of the collar shall extend to solid support at its base. All loose material shall be removed from the cut surfaces, and any surfaces to be in contact with newly placed concrete shall be cleaned to the base concrete or masonry, and thoroughly coated with cement grout before placing the concrete for the collar. Before inserting the pipe, a sufficient thickness of mortar shall be placed at the bottom and sides of the opening for proper bedding of the pipe. All spaces around the pipe shall be filled with mortar or concrete, and be neatly pointed up on the inside to form a smooth joint that is flush with the inner sewer surface.

   a. Payment will be made for properly handling all existing flows, cutting the opening in the sewer, constructing the concrete collar, and making the completed pipe connection at the bid price for making the complete pipe connection to the existing sewer.

4. New Manholes:

   a. If a new manhole must be constructed for the connection, the new manhole and invert shall be constructed over and around the sewer pipe to the elevation shown on the Project Plans. The work shall be done carefully to avoid breaks in the existing sewer until the manhole is completed. Any joints in the existing sewer shall be pointed up with 1:3 cement:sand mortar, if necessary to stop leakage before building the manhole. After construction of the manhole, the top half of the existing pipe shall be carefully cut and removed to be flush at each end with the inside wall and pointed up to present a neat smooth surface at the junction of the cut pipe with the invert and wall. The newly placed concrete, mortar, or plastering at the connection shall be protected from sanitary sewage or foulwater by completely covering with a thick coat of emulsified asphalt applied after initial set of the mortar or concrete. No sewage or water shall be permitted to touch the protected surfaces until the emulsion has set and properly hardened.

   b. Payment will be made for constructing a new manhole over an existing sewer at the bid price as described for manhole construction. The costs of properly handling all existing flows, cutting and removing the pipe, and pointing up are included in the payment made for manhole construction.

Section C. CROSSINGS OF RAILROADS, STREETS, AND HIGHWAYS.

1. General: Sewer crossings of railroads, streets, and highways shall be made as shown on the Project Plans and required in these specifications and the Project Specifications. The Contractor also shall inform himself of any additional requirements of the railroad, municipality, or highway department for working within its jurisdiction.

2. Crossings In Streets: Crossings in streets normally are made in open-cut construction, unless otherwise shown on the Project Plans to be made in stanks or in tunnels, and with special requirements as described in the Project Specifications. Construction and payment are described in Parts 3 and 4 for the particular items involved.

3. Crossings Under Highways: Crossings under highways will be made as shown on the Project Plans and Specifications. For arterial and major streets in the City and for County primary highways and for all State highways, crossings will be made in bore-holes or tunnels beneath paving, unless otherwise shown on the Project Plans. For residential and minor streets in the City and for County secondary highways and streets under County maintenance, crossings will be made as described above for street crossings, unless otherwise shown on the Project Plans.

4. Crossings Under Railroads: Crossings beneath railroads will be made in tunnels, unless otherwise required on the Project Plans. Work shall be done in full cooperation with the railroad company. The Contractor shall inform himself of any additional requirements of the company for working beneath its tracks or within its right-of-way.

Section D. REMOVAL AND REPLACEMENT OF PAVEMENTS AND ROAD SURFACES.

1. General:

    a. All existing paving or roadway surfacing, curb and gutter, of streets, alleys, driveways, sidewalks, paved areas, roads and highways, either removed or else damaged by the Contractor in his operations, shall be replaced to a condition at least equal to the condition before removal, and in conformance with the regulations of the agency of jurisdiction, and as required in these specifications. Cuts in all rigid base pavements and asphaltic concrete pavements shall be made to straight true saw cut lines parallel with each edge of the trench for the pipe or structure, or, if directed by the City, to the construction joint nearest the trench. Reasonable efforts shall be made to avoid contrast, clash, or lack of harmony in the color and texture of the restored surfaces.

    b. Pavement paylines shall not apply unless paving is encountered within the excavation payline widths.

2. Partially-Improved Roadway Wearing Surfaces:

    a. For partially-improved roadway wearing surfaces consisting of thin layers of crushed stone or gravel, either waterbound or treated with oils to provide an all-weather wearing surface, excavation will be classified as Class C excavation. Excavation and backfill will be made as described in Parts 3 and 4. After the back fill in the trenches has substantially dried and completed its settlement, and permission has been given by the Director, any settlement below the top eight inches of trench shall be refilled with compacted selected earth fill. A base of compacted crushed limestone and screenings, not less than eight inches thick,

and with voids filled with ½ inch minus screenings, shall be placed in the top eight inches of the trench. The surface shall be waterbound or treated with oils, and after drying, shall be submitted to the action of traffic. Before completion of the project, any settlement below the finished grade shall be refilled with additional compacted crushed limestone and screenings and similarly waterbound or oiled.

b. Payment will be made for the crushed limestone base at the bid price per square yard for "Crushed Limestone Base" for the area within payline limits for excavation for sewers and manholes or similar structures. Such payment shall include the cost of any additional crushed limestone and screenings used.

3. Bituminous Wearing Surfaces:

a. After the backfill in the trenches has substantially dried and completed its settlement, and permission has been given by the Director, a base of compacted limestone and screenings, not less than eight inches thick and with voids filled with ½-inch minus limestone screenings, shall be placed in the top eight inches of trench. A bituminous wearing surface consisting of bituminous materials and pea gravel shall be applied as required by the current specifications for patching bituminous pavement of the Missouri Department of Transportation (Standard Specifications for Highway Construction) to a strip, centered on the trench.

b. Payment will be made at the bid price per square yard for "Replacement of Bituminous Wearing Surface" for the area replaced, which shall not extend beyond two feet each side of the standard payline width of excavation for sewers, manholes and other structures, and shall exclude inlet sumps and curbing. Such payment shall include all costs of labor, equipment, oil, gravel, and crushed limestone and screenings for the completed base and wearing surface.

4. Asphaltic Concrete Street Pavement:

a. After the backfill in the trenches has substantially dried and completed its settlement, and permission has been given by the Director, asphaltic concrete, not less than eight inches thick, shall be placed on a primed base in accordance with the requirements of the municipality of jurisdiction or, if a municipality has no requirements, with the requirements of the Missouri Department of Transportation (Standard Specifications for Highway Construction).

b. Payment will be made for the asphaltic concrete at the bid price per square yard for "Removal and Replacement of Asphaltic Concrete Street Pavement" for the area replaced, which shall not extend beyond two feet each side of the standard payline width of excavation for sewers, manholes and other structures, and shall exclude inlet sumps and curbing. Such payments shall include costs of labor, equipment, primer, saw cutting and asphaltic concrete required for removing and replacing the completed base and pavement surface.

5. Rigid Base Pavements:

a. Pavements of Portland cement concrete, pavements on Portland cement concrete base, pavements of asphaltic concrete surface course on existing pavements of Portland cement concrete, or pavements of asphaltic concrete surface course on old pavements of brick or cobblestone base shall be

considered rigid base pavements. After the backfill in the trenches has substantially dried and completed its settlement, and permission has been given by the Director, the removed rigid base pavements shall be replaced as follows:

i. Pavements of Portland cement concrete shall be replaced with Class A concrete pavement not less than eight inches thick. It shall be reinforced with six by six inch, eight-gauge, welded wire mesh, meeting the requirements of ASTM A185 specifications, placed and held at two inches from the bottom of the concrete and extending six inches beyond each edge of the trench. The surfaces of the cut concrete shall be clean and free of loose particles. Immediately before any concrete is placed against the cut surfaces, they shall be thoroughly coated with cement grout. The completed pavement surfaces shall be finished to the same level and texture as the adjoining pavement, and shall be protected from damage, rapid drying or freezing. Any paving beyond the allowed payline limits for the pavement which may be damaged by the Contractor shall be replaced with no additional payment.

ii. Payment will be made for the concrete pavement removed and replaced at the bid price per square yard for "Removing and Replacing Concrete Pavement." The area for which payment will be made shall not extend beyond lines extending two feet beyond each payline for excavation for sewers, manholes and similar structures, and shall exclude inlet sumps and curbing.

b. Pavements of asphaltic concrete surface course on existing pavements of Portland cement concrete base or on brick and concrete or cobblestone and concrete or cobblestone base, the pavement shall be replaced with two inches of asphaltic concrete surface course on Class “A” concrete pavement base not less than eight inches thick, constructed as required for Portland cement concrete pavement except for the requirement of surface texture.

i. Payment will be made at the bid price per square yard for Removing and Replacing Asphaltic Concrete Surface Course and Pavement Base for the area removed within payline limits of two feet beyond each payline for excavation.

6. Sidewalks and Driveways:

a. Removal of sidewalks and driveways of concrete shall be made to the nearest joint or edge in the concrete pavement. Care shall be used to avoid damage to the adjacent pavement remaining in place. If the adjacent pavement is damaged or cracked by the operations of the Contractor, the pavement area enclosed between the payline limit as directed and a line parallel with such payline and including the damaged pavement shall be replaced at the expense of the Contractor. After the backfill in the trenches has substantially dried and completed its settlement, and permission has been given by the Director, the removed pavements shall be replaced as follows:

i. The removed concrete sidewalks and concrete driveways shall be replaced with similar pavements of Class “A” concrete to a thickness not less than four inches, nor less than the thickness required by the municipality of jurisdiction. It shall be reinforced with six by six inch, eight-gauge, welded wire mesh. The surfaces of the cut concrete shall be clean and free of loose particles. Immediately before any concrete is placed against the cut surfaces, they shall be thoroughly coated with cement grout. The pavement surfaces shall be finished to the same level, texture, and color as the adjoining pavements and shall be protected from damage, rapid drying, or freezing.

ii. Payment will be made at the bid price per square yard for Removal and Replacement of Concrete Sidewalks and Driveways. The area for which payment will be made shall not extend past the nearest joint or edge of the concrete pavement beyond the payline for excavation for sewers, manholes and similar structures. Cuts for trenches in asphaltic sidewalks and driveways shall be made by saw cut to straight true lines located on the payline limits of excavation for the trench or structure.

b. The removed or damaged asphaltic pavement shall be replaced with paving similar to that removed, but not less than two inches thick, nor less than the thickness required by the municipality of jurisdiction. Sidewalks passing through driveways and driveway approaches are considered driveways for the purpose of removal, replacement and payment.

i. Payment will be made at the bid price per square yard for Replacement of Asphalt Sidewalks and Driveways. The area for which payment will be made shall not extend beyond two feet each side of the standard payline for excavation for sewers, manholes, and similar structures.

c. Payment for unimproved drives of gravel or crushed rock surfacing shall be included in the payment made for site restoration, unless otherwise specified in the project specifications.

7. Curb and Gutter:

a. When necessary to remove concrete or asphaltic concrete curb and gutter, the cuts shall be made to straight true lines perpendicular to the alignment of the curb, and shall be located two feet beyond each payline of trench, or when so directed, to the nearest construction joint within an approximate distance of two feet beyond the trench payline. When granular fill compaction and settlement has been completed, the removed curb shall be replaced with similar matching curb and gutter in accordance with the specifications of the municipality of jurisdiction. Asphaltic concrete curb shall be machine laid, if in excess of 10 feet in length.

b. Payment will be made for removing and replacing concrete curb and gutter or asphaltic concrete curb and gutter at the respective bid price per lineal foot for the actual length required to be removed and replaced, exclusive of curb and gutter removed and replaced in inlet construction.

c. Curbs not requiring forms on the exposed surface as well as the unexposed surface will be considered pavement for the purpose of removal, replacement and payment.

8. Backfill Under Pavements and Roadway Wearing Surfaces: Backfill in trenches through pavements shall be made with water jetted granular fill which shall extend two feet beyond the edge of street pavements at the level of their bases, and one foot beyond the edge of driveways and sidewalks at the level of their bases.

Section E. ROCK BLANKET.

1. Construction Requirements:

   a. When required by the Project Plans or otherwise directed that banks are to be protected with rock blanket, the excavation or compacted fill shall be made to such surfaces and elevations that will permit placing of the surfacing without extending beyond or above the lines of the required channel cross section. No rock blanket shall be placed on any bank fill that has not been compacted.

   b. The material to be used in the construction of a rock blanket shall be crushed limestone conforming to the requirements of Type 5 - Light or Type 6 - Heavy, as described in Part 2 of these specifications.

   c. Dumped rock shall be neatly placed, and shall not be less than one foot thick for Type 5 – Light or not less than two feet thick for Type 6 - Heavy on the sides and on the bottom as shown on the “Typical Rock Blanket Detail”. The surface shall be reasonably regular and uniform.

2. Payment: Payment will be made at the unit bid price per square yard of rock blanket (light or heavy). The area for payment shall be computed from the exposed plane surface of the walls and bottom.

Section F. ABANDONMENT.

1. Sewers: Sewers to be abandoned shall be securely blocked at any points of intake or discharge with a bulkhead or pre-formed plug. When directed by the Project Plans and Specifications, they shall be completely filled with an approved material. The proposed method of filling and blocking the sewer shall be submitted to the City for approval. The Contractor will be allowed to remove that portion of the sewer to be abandoned in lieu of filling and blocking. If the Contractor elects the removal method, all costs for backfilling the excavation and all costs for surface restoration, in addition to removing and properly disposing of the pipe, shall be included in the unit bid price for Abandonment.

2. Manholes and Inlets:

   a. After removing the manhole frame and cover, all incoming and outgoing pipes shall be bulkheaded. The walls shall be lowered to two feet below final grade if in earth or to below subgrade if in pavement.

   b. The structure shall then be filled with granular material. Selected earth shall be used to bring the surface to final grade or the subgrade and pavement shall be replaced in paved areas.

3. Septic Tanks:

   a. When the Plans call for the abandonment of a septic tank, the Contractor shall pump out and properly dispose of the contents within the tank.

   b. The bottom of the tank shall be perforated to allow for drainage. If the top of the tank is concrete, it may be broken up and deposited in the tank. The sidewalls shall be lowered to at least two feet below final grade. The remainder of the tank shall be filled with granular material. Selected earth shall be used to bring the surface to final grade.

4. Payment for Abandonment: Payment for the work and materials required to abandon sewers, manholes, and septic tanks in accordance to the methods described above, will normally be made by a respective bid item at a cost per cubic yard or cost per place. If no bid price is provided, abandonment will not be paid for separately.

Section G. SIGNS.

When required by the Project Specifications, the Contractor shall furnish a sign at each of his major work locations to inform the public of the work under construction. No additional payment will be made for the required signs.

Section H. OFFICE SPACE.

When required in the Project Specifications, the Contractor shall provide and maintain on or near the site or work an office or office space for the exclusive use of the City. Such office or space shall have a floor space not less than one hundred fifty square feet in area; have a tight floor, water-tight roof and sides, door and lock, sufficient windows for light and ventilation, screens for all openings; toilet facilities and lavatory connected to sewer and water supply. There shall be supplied a clothes locker with lock and key, a table suitable for use as a drafting board, a desk, at least 3 chairs, a plan rack, electric lights, and a telephone. The Contractor shall keep the office cleaned, lighted, heated, and shall furnish telephone service without cost until completion of the work for the project. Payment will be made for the costs of providing and removing office facilities at the lump sum bid price for Site Office Space.

PART 7 – PROTECTION AND RESTORATION OF SITE

Section A. CONTRACTOR RESPONSIBILITY.

1. The Contractor shall protect and avoid damage to all public and private property along the line of work. Damage due to the carelessness of the Contractor shall be repaired or restored at his expense. Particular attention shall be paid to avoid damage to trees, shrubs, bushes, and private property located in and adjacent to easements on private property. No trees may be removed outside the limits of sewer easements without the permission of the property owner. The removal of trees, shrubs and plants within the easement lines necessary to construct the project may be removed and not replaced, unless otherwise shown on the plans or provided in the Project Specifications. At the City's direction, specific trees, shrubs, or plants may be required to be removed and properly disposed of or left in place and protected. Reasonable lengths (250 lineal feet) of temporary fencing may be required as ordered by the City, the cost of which shall be included in "Protection and Restoration of Site".

2. In occupied residential lots, damaged shrubbery or trees outside the easement lines shall be replaced with new plants of equal type and quality. Finished lawn areas upon which earth has been deposited shall be cleared to the level of the existing sod, raked and watered. Areas where sod has been damaged, destroyed, or ruts have been filled in, shall be resodded. Areas where the sod is only slightly damaged may be lightly reseeded, if so permitted. After final restoration of the settled trench surfaces, trench areas shall be resodded, unless otherwise required in the Project Specifications

Section B. TEMPORARY EROSION AND SEDIMENT CONTROL.

1. If the sum of the total disturbed area (estimated working room width x length of project) exceeds one (1) acre, the Contractor will be required to submit to the City for acceptance his plan for control of runoff from the project site.

2. The Contractor's plan shall exercise best management practices (BMP) throughout the duration of the project in order to control water pollution and siltation from surface runoff. Such practices may include, but not limited to: (1) Minimizing the area disturbed and the duration of exposure at one time; (2) Stabilization of the exposed area as soon as practical by temporary seeding and mulching or sodding; (3) Retainage/management of site runoff by use of berm, slope drains, ditch checks, bales, or silt fences; (4) Retainage of silt and other debris. Pollutants such as chemicals, fuels, lubricants, bitumens, or other harmful materials shall not be discharged from the site.

3. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other State, Federal or local agencies; the more restrictive laws, rules or regulations shall apply. It will be the responsibility of the Contractor to bring these to the attention of the City.

4. Payment shall include furnishing, installing, maintaining and removing all temporary control measures. Maintenance of control measures includes, but is not limited to periodic silt, debris and waste removal. Payment for this work will be included in the Pay Item "Protection and Restoration of Site".

Section C. AGREEMENTS WITH PROPERTY OWNERS.

The requirements of special arrangements made by the City with property owners at particular locations will be shown on the plans or specifications. Before entering upon any site, the Contractor shall provide the City with a signed copy of any agreement made between its owner and the Contractor for access, working space, and restoration of site. If, in special cases, fences, trees, shrubs, or plants are to be removed by the property owner and replaced at no expense to the Contractor, such cases will be stated in the Contract Specifications.

Section D. CLEANUP.

Debris and unused materials shall be removed from the working areas without unreasonable or unnecessary delay, and the working areas restored as nearly as practicable, as determined by the City, to their original conditions as soon as possible, in order to minimize damage, hazard, and inconvenience to the public and to the concerned property owners.

Section E. FENCES.

1. After construction is substantially complete fences shall be built or replaced after ground settlement due to construction. Fence replacement shall be in and constructed to equal or better condition of that removed. Fences elected to be removed by the Contractor to allow construction but in such poor condition as to not be reerected shall be replaced with new fence, the cost of which shall be included in protection and restoration.

2. Unless otherwise required in the Project Specifications or on the Project Plans, fence fabric shall be No. 11 gauge wire mesh, woven in a 2-inch mesh, and shall be 48 inches high. Fabric shall have a minimum 1.2 oz. galvanized coating per square foot of wire surface, and shall conform to ASTM A392 Specifications.

3. Metal line posts, corner posts, and top rails shall conform to ASTM A120 Specifications "Standard Weight" pipe (Schedule 40), with a galvanized coating not less than 1.8 oz. per square foot of total coated surface. Minimum pipe sizes shall be as follows:

    a. Line Posts; 1-½-inch nominal size (1.9" O.D.), 2.72 lb. per lin. ft.
    b. Corner Posts; 2-inch nominal size (2.375" O.D.), 3.65 lb. per lin. ft.
    c. Top Rails; 1-1/4-inch nominal size (1.66" O.D.), 2.27 lb. per lin. ft.

Section F. SODDING.

1. The project area shall be properly graded to insure that there are no ponding areas.

2. Unless otherwise required in the Project Specifications or on the Project Plans, the prepared surface of trenches in lawns and turfed areas and in areas required to be regraded as a part of the construction, and turfed or lawn areas damaged by the Contractor, shall be restored by resodding.

3. After restoration of settled surfaces of the trench with earth, or the filling of rutted areas damaged by the Contractor's equipment, all areas will be sodded. They shall be fine graded and raked to a smooth even surface, approximately one inch below the required finished surface with smooth transitions to adjacent undisturbed areas. Commercial fertilizer shall be uniformly distributed and raked into the prepared surface at the rate of eight pounds per one-thousand square feet. Unless otherwise specified, the fertilizer shall be a standard commercial product with a minimum composition of 4 percent

available nitrogen, 12 percent available phosphates, and 4 percent potash. The sod shall be laid with closely-butted joints on the prepared, finished, fertilized moist subgrade; rolled and thoroughly watered; and kept moist until acceptance of the work in lawn areas. The sod to be used shall be bluegrass, free from weeds, leaves, debris and excessive amounts of decomposed vegetable matter. It shall be surface clipped in the field to a two-inch grass height; be in strips of uniform width cut with straight edges and ends; be approximately twelve inches wide and three to five feet long; have an adequate root system not less than one inch thick; and be fresh cut, moist, and in good condition. Upon completion of sodding it will be the contractor's responsibility to maintain the newly placed sod in a moist condition for a minimum of two weeks after the placement of the last section of sod.

4. Sodded areas outside of the payline limits for sodding described above and upon which earth has been deposited, and removed without leaving deposits of earth or damaging the sod, shall be raked smooth, fertilized at the rate of four pounds per one-thousand square feet, and thoroughly watered. Areas outside of payline limits which have been damaged shall be resodded. Areas of slightly damaged sod may be reseeded only with the approval of the Director.

5. Such sodded areas shall be raked and fertilized at the rate of four pounds per one-thousand square feet, and lightly seeded at the rate of two pounds per one-thousand square feet. Payment for the work of raking, watering, and light reseeding if required, is included in the lump sum payment made for restoration of site.

6. No sod shall be accepted until it has rotted into the subgrade. Payment for sodded areas will be made at the bid price per square yard and will include all costs of preparation, fine grading to finished grade, fertilizing, furnishing and placing sod, and watering, complete in place for the areas required to be sodded, but exclusive of sodding required at the Contractor's expense in restoration of areas damaged by the Contractor's equipment or operations. The width for which payment will be made for sod will be 20 feet wide. The 20 foot width shall be centered on the pipe. Areas of paved surfaces and obstacles shall be excluded from payment for sod. Sodding required beyond these limits will be paid for under the Pay Item "Protection & Restoration of Site."

Section G. SEEDING.

1. If required on the Project Plans or in the Project Specifications that seeding is to be used instead of resodding for specially designated areas, such areas shall be fine graded and raked to the required finished surfaces and grades, and fertilized as described for sodding. Unless otherwise provided in the Project Specifications, seed to be used shall be a good grade of suitable mixed lawn grass, approved by the State of Missouri for viability and freedom from excessive amounts of weed seeds. Such approved seed mix shall consist of: 80 percent Fiesta 11 Rye and 20 percent Touchdown Kentucky Blue Grass or 1. Kentucky Blue Grass, not less than 65 percent; 2. Red Fescue, 15 percent: 3. Red Top, 5 percent; 4. Annual Rye, 15 percent.

2. The seed shall be evenly sown on the prepared, moist, fertilized (13-25-12) surface at the rate of six pounds per one- thousand square feet, lightly raked, and covered with pulverized straw, rolled, watered with a fine spray to avoid washing of the seed, and kept moist until acceptance of the work. When so provided in the Project Specifications, payment for such seeded areas will be made at the bid price per square yard, on the same basis as sod, and will include all costs of preparation, fine-grading to finished grade, fertilizing, furnishing and sowing seed, and watering, complete in place for the

areas directed to be seeded. In case that no pay item is provided, all costs of seeding as described are included in the lump sum payment made for protection and restoration of site.

Section H. APPROVAL AND PAYMENT.

1. General:

   a. Before final approval of the project, a complete inspection will be made of the areas in which the Contractor has worked or has used for access to the work, in order to determine that damage has been repaired and the site restored as required by the specifications, and as agreed in any private agreements between the Contractor and the property owners, whether filed with the City as required or else not reported. Final approval for restoration of pavements, wearing surfaces, sidewalks, and drives will be given by the municipal or county authority of jurisdiction. Final approval will be withheld until the Contractor has repaired the damage and restored the site as required by the specifications and by any private agreement with a property owner.

   b. All costs of property protection, cleanup and restoration of site and working areas, except for pavement replacement, sodding, and for special items described in the Project Specifications, are included in the lump sum payment for Protection and Restoration of Site, unless otherwise provided in the Project Specifications.

Section I. SIGNS.

1. When required by the Project Specifications, the Contractor shall furnish a sign at each of his major work locations to inform the public of the work under construction. No additional payment will be made for the required signs.

Section J. OFFICE SPACE.

1. When required in the Project Specifications, the Contractor shall provide and maintain on or near the site or work an office or office space for the exclusive use of the City. Such office or space shall have a floor space not less than one hundred fifty square feet in area; have a tight floor, water-tight roof and sides, door and lock, sufficient windows for light and ventilation, screens for all openings; toilet facilities and lavatory connected to sewer and water supply. There shall be supplied a clothes locker with lock and key, a table suitable for use as a drafting board, a desk, at least 3 chairs, a plan rack, electric lights, and a telephone. The Contractor shall keep the office cleaned, lighted, heated, and shall furnish telephone service without cost until completion of the work for the project. Payment will be made for the costs of providing and removing office facilities at the lump sum bid price for Site Office Space.

END OF STANDARD SPECIFICATION