City of Farmington, Missouri

General Conditions
and
Technical Specifications
for
Public Improvements

JUNE 2024

Adopted June 24, 2024

Larry Lacy, P.E.
Director of Public Works

ORIGINALLY PREPARED IN CONJUNCTION WITH

530A East Independent Drive
Union, MO 63084
(636)584-0540

CITY OF FARMINGTON, MISSOURI

GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS FOR PUBLIC IMPROVEMENTS

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CITY OF FARMINGTON

BILL 29062024 **ORDINANCE 11-2I 199**

AN ORDINANCE OF THE CITY OF FARMINGTON, MISSOURI, AMENDING THE MUNICIPAL CODE OF THE CITY OF FARMINGTON, BY ADDING A NEW CHAPTER ADOPTING GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS FOR PUBLIC IMPROVEMENTS.

WHEREAS, upon recommendation of the City Administrator and Public Works Director, the City has prepared and reviewed certain regulations pertaining to the construction of public works improvements within the City; and,

WHEREAS, the proposed regulations were made publicly available for review and comment, and certain revisions were made to the proposed regulations based on comments that were received; and,

WHEREAS, the Planning and Zoning Commission reviewed the proposed regulations on May 13, 2024 and forwarded to the City Council with a favorable recommendation for approval; and

WHEREAS, the proposed regulations were made publicly available for review and comment, and the City held a public hearing on June 13, 2024 wherein all interested parties were afforded the opportunity to comment on the proposed regulations; and,

WHEREAS, the City Council desires to amend the Municipal Code to incorporate the proposed regulations; now therefore,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF FARMINGTON, MISSOURI, AS FOLLOWS:

SECTION 1. That the Municipal Code of the City of Farmington, Title IV: Land Use is hereby amended by adding the following new Chapter 427 as follows:

Chapter 427

GENERAL CONDITIONS AND TECHNICAL SPECIFICATIONS FOR PUBLIC IMPROVEMENTS

ARTICLE I
General

Section 427.005. Title

This Chapter shall be known and may be cited as "Design Standards for Public Works".

Section 427.008. Definition of Abbreviations.

AASHTO – American Association of State Highway and Transportation Officials

ACI - American Concrete Institute

ANSI – American National Standards Institute

ASTM – American Society for Testing and Materials

AWWA – American Water Works Association

IMSA – International Municipal Signal Association

ITE – Institute of Transportation Engineers

NEMA – National Electrical Manufacturing Association

USAI – United States of America Standards Institute

Section 427.010. Definitions.

As used in this Chapter, the following words and phrases shall have the meanings respectively ascribed to them:

Advertisement - The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

Award - The action of the City accepting the proposal of the lowest responsible bidder for the work, subject to the execution and approval of a satisfactory contract therefor and bond to secure the performance thereof, and to such other conditions as maybe specified or as required by law.

Bidder - Any individual, partnership, corporation, or joint venture submitting a proposal to perform the work contemplated.

Bid Security - A bid security shall be a bond provided by a surety company authorized to do business in this State, or the equivalent in cash, or otherwise supplied in a form satisfactory to the City in an amount equal to or at least 5% of the amount of the bid.

Change Order - A written order from the City, the Director of Public Works or Owner to the contractor, as authorized by the contract, directing changes in the work as made necessary or desirable by unforeseen conditions or events discovered or occurring during the progress of the work.

Contract Documents - The contract documents shall include, but not be limited to, the signed Contract and Bond, Addendum, Notice to Contractors, Instructions to Bidders, signed copy of the Bid, General Conditions, Special Provisions, Technical Specifications, and Plans and / or

Supplemental Sketches. The signed contract, together with the other documents enumerated herein or herein before, forms the Contract between the parties. These documents are as fully a part of the contract as if attached thereto or repeated therein.

Contract Bond - The form of security approved by the City to be used by the contractor and his surety or sureties guaranteeing complete performance of the contract and the payment of all legal debts pertaining to the construction of the project, and conditioned as may be required by the Code of the City of Farmington, Missouri.

Contract Time or Completion Date - The number of calendar days shown in the proposal, including authorized extensions, is the time allowed for the completion of the work contemplated in the contract. If a calendar date for completion is shown in the proposal, then the work contemplated shall be completed by that date. A calendar day is defined as everyday shown on the calendar (including weekends and holidays). No time extensions will be granted for delays caused by weather, utility conflicts, excavations encountering rock, changing excavation quantities or contractor scheduling.

Contractor - The individual, partnership, corporation, or joint venture undertaking performance of the work under terms of the contract, and acting directly or through his or its agents, employees, or subcontractors.

Director of Public Works - The Director of Public Works for the City of Farmington, Missouri.

Engineer - A professional engineer registered in the State of Missouri. Within the technical specifications included in this document, the term "Engineer" refers to the Director of Public Works or his duly authorized representative.

Extra Work - An item of work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract and within the intended scope of the contract, as determined by the Director of Public Works.

Notice to Contractors - The notification provided prospective bidders, containing a general description of the proposed work, and including information and requirements for the submission of bids.

Notice to Proceed - The written notice from the City notifying the contractor of the data which he is to begin execution of the work.

Owner - Any person or entity owning or sponsoring any work pertaining to public infrastructure, such as land owner, developer or his assigned representative.

Pay Item - An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of any and all work and the furnishing of any and all labor, equipment, and materials contemplated or described on the plans or in the text of the specifications included in the contract.

Plans - Drawings or reproductions thereof approved by the City of Farmington, Missouri, which show the location, character, and details of the work. Technical Specifications and Special Provisions shall prevail over plans when in conflict therewith.

Project - The proposed improvement together with all appurtenances and construction to be performed thereon under the contract.

Proposal - The written offer submitted by the bidder in the required manner on the form of proposal to perform the work contemplated at his bid prices.

Form of Proposal - The approved form furnished by the Public Works Department on which the bid prices for the work are to be submitted.

Proposal Guaranty - The security furnished with a proposal to ensure that the bidder will enter into the contract if his proposal is accepted.

Responsible Bidder - Any person, firm, or corporation submitting a bid for the work contemplated who maintains a permanent place of business, has adequate plant equipment to do the work properly and within the time limit that is established, and has adequate financial status to meet his obligations contingent to the work.

Responsive Bidder - Any person, firm, or corporation submitting a bid for the work contemplated whose Bid Form is complete and regular, free of exclusions or special conditions and has no alternative bids for any item unless requested in the Technical Specifications and has submitted all required information with the bid.

Right-of-Way - The land opened, reserved or dedicated for a street, sidewalk, drainage or other public purpose.

Special Provisions - Directions or requirements, peculiar to the work and not otherwise thoroughly or satisfactorily detailed or set forth in the general conditions or technical specifications. Special provisions may be included in the specifications or may be included as a note or special detail on the plans. Special provisions shall prevail over general conditions, technical specifications, and plans whenever in conflict therewith.

Specifications - The directions, provisions, and requirements contained in these general conditions and technical specifications, together with such as may be added or adopted as supplemental specifications or special provisions for the performance of the work and for the quantity, quality, and proportion of materials.

Subcontractor - Any individual, partnership, corporation, or joint venture to which the contractor, with the consent of the City, sublets any part of the work under the contract.

Surety - A corporate body duly authorized to do business in the State of Missouri, and which has executed a bid bond with the bidder or a contract bond with the contractor.

Work - The furnishing of all labor, materials, equipment, and other incidentals necessary or convenient to the successful completion of the project and the carrying out of all duties and obligations imposed by the contract documents.

Working Drawings - Shop drawings, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the contractor is required to submit to the Director of Public Works for approval.

Section 427.015. General Conditions

Contract terms included in this Chapter apply to City projects only. Owners shall develop their own contractual terms for their contracts with contractors. Construction and inspection requirements included in Section 427 applies to all Public Works projects.

A. Bidding Requirements and Conditions

1. Notice to Contractors. After the date is fixed for the receipt of bids, the Director of Public Works may, in addition to the notice required by law, give notice of such date by mail to those contractors who are on file with the Public Works Department for the type of work involved in the contract being bid. Others will be mailed a Notice to Contractors upon request. This Notice to Contractors will contain a general description of the proposed work, together with instructions and information to the potential bidder regarding specifications, approved plans, special provisions, form of proposal, and other documents affecting the work.

2. Coordination of Plans, Technical Specifications, and Special Provisions. These Specifications, Approved Plans, Special Provisions, Form of Proposal and all documents affecting the work issued by the Director of Public Works to the contractor are essential parts of the Contract and a requirement occurring in one is as binding as though occurring in all. They are intended to be mutually complementary. In case of discrepancy, calculated dimensions shall prevail over scaled dimensions; Special Provisions shall prevail over Technical Specifications; Technical Specifications shall prevail over Plans and Drawings.

3. Interpretation of Quantities in Bid Schedule. The quantities appearing in the bid schedule are approximate only and are prepared for the comparison of bids. Payment to the contractor will be made only for the actual quantities of work performed and accepted in accordance with the contract, except where final measurements are not made, as herein after provided. The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted as herein after provided.

4. Examination of Plans, Specifications, Special Provisions, and Site of Work. The Director of Public Works will prepare plans and specifications giving such directions as to enable the contractor to carry them out. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, supplemental specifications, special provisions, and other contract documents before submitting a proposal. The

plans, specifications, and other documents designated in the proposal form will be considered a part of the proposal whether attached or not.

a. It is the responsibility for each bidder before submitting a bid to (a) examine the contract documents thoroughly, (b) visit the site to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the work, (c) consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing of the work, (d) study and carefully correlate bidder's observations with the contract documents, and (e) notify City of all conflicts, errors, or discrepancies in the contract documents, but the submission of a bid shall be considered proof that the bidder has made his own examination and is satisfied as to the conditions to be encountered in performing the work and as to the requirements of the plans, specifications, supplemental specifications, special provisions, and other contract documents. The conditions indicated on the plans and in the proposal represent information available from surveys and studies.

b. Information and data reflected in the contract documents with respect to underground facilities at or contiguous to the site is based upon information and data furnished to the City by owners of such underground facilities or others, and neither the City nor the Director of Public Works assumes any responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Special Provisions.

c. Provisions concerning responsibilities for the adequacy of data furnished to prospective bidders on subsurface conditions, underground facilities, and other physical conditions, and possible changes in the contract documents due to differing conditions appear in Chapter II, paragraph G.5 of the General Conditions.

d. Before submitting a bid, each bidder will be responsible to make or obtain such explorations, tests, and data concerning physical conditions (surface, subsurface, and underground facilities) at or contiguous to the site, or otherwise which may affect cost, progress, performance, or furnishing of the work and which bidder deems necessary to determine its bid for performing and furnishing the work in accordance with the time, price, and other terms and conditions of the contract documents. If bidder elects to make explorations in public street rights-of-way, an excavation permit must be obtained from the Public Works Department.

e. Karst features may exist beneath the surface on the project site which was not detected by the City's subsurface investigation and which is not depicted in the project drawings. Contractor expressly acknowledges that no representations are made in the project drawings or plans as to either the presence or absence of karst features and contractor agrees to be stopped from making any claims to the contrary.

5. All proposals must be properly signed and sealed and submitted as set forth in the Advertisement for Bids and/or the Information for Bidders. Each bidder shall specify in

his proposal, in figures, a unit price for each of the separate items listed in the proposal. The proposal shall not contain interlineations, alterations, or erasures except as noted in Sec. A.6.a below. The bidder shall show the products of the respective unit prices and quantities in the amount column provided for that purpose. These extensions shall be totaled and in case of errors or discrepancies in extensions, the unit prices shall govern. All entries on the proposal form shall be in ink or typed. All errors in extensions or totals will be corrected by the City and such corrected extensions and totals will be used in comparing bids.

a. A bidder may alter or correct a unit price, lump sum bid, or extension entered on the proposal form by crossing out the figure with ink and entering a new unit price, lump sum bid, or extension above, below, or the side in ink, and initialing the alteration or correction. If an alteration or correction of a unit price or lump sum bid is not initialed, the original unit price or lump sum bid will be assumed to be correct. All corrections must be made before any bids have been opened.

b. A proposal of an individual, including those doing business under a fictitious name, shall be signed by the individual, and his address shown.

c. A proposal by a partnership or joint venture, including individuals doing business under fictitious names, or corporations, shall be executed by at least one of the partners followed by the title "Partner," or one of the joint ventures followed by the title "Joint Venture" and the business address of the partnership or joint venture shown. The true legal name and address of each partner and joint venture shall also be shown.

d. A proposal by a corporation, whether acting alone or as a joint venture, shall include the address and name of the corporation and shall be signed by a person authorized by its Board of Directors to bind the corporation, with his title shown.

e. The name and address of the bidder shall be stated the same on all Contract Documents including the proposal, bid bond, contract, performance bond and insurance policies and certificates.

f. If the successful bidder is doing business in the State of Missouri under a fictitious name, such bidder shall furnish to the director of Public Works a certified copy of its registration of fictitious name issued by the Secretary of State, State of Missouri. No contract will be executed by the City until such certificate is furnished by the bidder. If the successful bidder already has on file with the Director of Public Works such a certificate, an additional certificate will not be required.

g. All successful bidders who are corporations organized in states other than Missouri, shall furnish at their cost, a certified copy of a certificate of authority and license to do business in Missouri, said certificate to remain on file with the Director of Public Works. No contract will be executed by the City until such certificate is furnished by the successful bidder. If the successful bidder already has on file with the Director of

Public Works such a certificate, an additional certificate will not be required. The successful bidder agrees to cause its authority and license to do business as a foreign corporation to be continued and extended throughout the life of the contract, and until all claims thereon and thereunder shall have been finally settled.

h. All successful bidders must have or must obtain vendor authorization and an occupational license with the City of Farmington, Missouri. The cost for this occupational license shall be borne by the bidder. No contract will be executed by the City until this vendor authorization and occupational license has been obtained.

i. Where in the proposal form a "Unit Price" is set forth, the "Unit Price" shall include the furnishing by the contractor of all labor, tools, materials, machinery, appliances, plant and equipment appurtenant to, and necessary for the construction in every detail and the completion in a first class, workmanlike manner of all the work to be done under these qualifications. The "Unit Price" shall also include all permanent protection of overhead, surface and underground structures, dust control during construction, cleaning up, finish, overhead expense, bond, insurance, patent fees, royalties, risk due to the elements, delay, profit, injuries, damages, claims, and all other items not specifically mentioned that may be required to fully construct each item of work complete and in place. Contractors are warned that unbalancing of bids may be cause for rejection. Proposals that show any omissions, alterations of form, additions not called for, conditional or alternate bids not called for, or irregularities of any kind may be rejected.

j. All proposals must be accompanied by a cashier's check or certified check for not less than five (5%) percent of the amount of the bid and made payable to the City of Farmington, Missouri, or an acceptable bidder's bond guaranteed by a corporate surety company engaged in the business of signing surety bonds in the State of Missouri, said bidder's bond or check to be paid unconditionally to the City of Farmington in the amount of not less than five (5%) percent of the bid.

k. A bidder may withdraw or revise a proposal after it has been deposited as set forth in the Advertisement for Bids and/or the Information for Bidders, provided the revision or the request for such withdrawal is received before the time set for opening proposals. Any proposal received after the time for opening of bids will be returned to the bidder unopened.

l. Proposals will be opened and bid totals read publicly at the time and place indicated in the Advertisement for Bids and/or the Information for Bidders. Bidders, their authorized agents, and other interested parties are invited to be present.

6. Right to Reject Proposals. The City reserves the right to reject any or all bids and waive technicalities if it is in the best interest of the City and may resubmit an invitation for bids with the same specifications to the same or other persons or award to the next lowest responsible responsive bidder. Reasons for rejection of proposals will not be limited to but may include the following:

a. Lack of competency and adequate machinery, plant and / or other equipment, as revealed by the "Statement of Bidders Qualifications."

b. Uncompleted work which, in the judgment of the City might hinder or prevent the prompt completion of additional work if awarded.

c. False information provided on the "Statement of Bidders Qualifications."

d. Failure to pay, or satisfactorily settle, all bills due for labor or materials on former contracts.

e. Failure to comply with any pre-qualification regulations of the City.

f. Default under previous contracts.

g. Unsatisfactory performance record as shown by past work for the City judged from the standpoint of workmanship and progress.

h. When any agent or employee of the prospective bidder currently serves as an employee or agent in the City.

i. When any agent or employee of the prospective bidder has participated in the preparation of plans or specifications for the proposed work.

j. More than one proposal for the same work from an individual, firm, partnership or corporation under the same or different names.

k. Evidence of collusion among bidders.

l. Unbalanced proposals in which the bid prices for some items are obviously out of proportion to the bid prices of other items.

m. If the proposal does not contain a unit price for each pay item listed except in the case of authorized alternate pay items or lump sum pay items.

n. If there are omissions, erasures, unauthorized additions, conditional bids, or irregularities of any kind which may tend to make the proposal incomplete or ambiguous as to its meaning.

o. If the proposal is prepared other than ink or typewriter.

B. Award and Execution of Contract

1. After the proposals are opened and the bid totals read, they will be compared on the basis of the summation of the products of the approximate quantities shown in the bid

schedule multiplied by the unit bid prices. The results of such comparisons will be immediately available to the public.

2. The contract will be awarded by the City to the lowest responsible responsive bidder as soon as practicable after the opening of the bids. The responsibility of the contractor will be determined by the City. If the Federal Government or any agency thereof is paying all or a portion of the cost of construction of the project, the award made by the City will be tentative until proper concurrence of the Federal Government or agency therein has been received. In making the award, if alternate bids have been requested, that alternate which will be in the best interest of the City will be used.

3. For bids in excess of fifty thousand dollars ($50,000.00), the successful bidder shall at the time of the execution of the contract furnish a surety bond in an amount at least equal to one hundred (100%) percent of the total amount of the contract, as evidenced by the proposal tabulation, guaranteeing the full and prompt completion of the work and performance of the contract, and for the protection of the City. The bond shall be to the City of Farmington, Missouri. If the bond is executed by a surety which is a corporation organized in a state other than Missouri, it shall be countersigned by a Missouri resident agent of such corporation. All proposals shall be accepted, contingent upon furnishing a contract bond executed by an approved surety.

4. The names, addresses, telephone numbers, and proposed work items and amount of all subcontractors the bidder expects to use in performing the work under this proposal shall be furnished with the bid proposal. If no subcontractors are expected to be used, a statement to that effect must accompany bid proposal. After the bid opening the successful bidder may not substitute any of the subcontractors identified in the bid, except with the approval of the Director of Public Works and for good cause shown. The availability of another subcontractor at a lower cost to the general contractor after bid opening shall not constitute good cause for such substitution.

   a. If after due investigation the Department of Public Works has reasonable objections to any proposed subcontractor before the notice of award is given, the department may request the apparent low bidder to submit an acceptable substitute without an increase in the bid price. If the apparent low bidder declines to make any such substitutions, the Department of Public Works may award the contract to the next lowest bidder that proposes to use acceptable subcontractors. The decline to make requested substitutions will not constitute grounds for sacrificing the bid security of any bidder.

   b. The contractor shall not assign or sublet any portion of the contract not previously identified to be sublet at the time of bid opening, without the written approval of the Director of Public Works. The Director's written approval of the contractor subletting work shall not be construed as making the City a part of such subcontract, or subjecting the City to liability of any kind of any subcontractor.

   c. No subcontractor shall under any circumstances relieve the contractor or his surety of his liability and obligation under the contract, and all transactions will be made

through the contractor. Subcontractors will be recognized and dealt with only as workmen and representatives of the contractor.

d. If approval is given for subletting work, the contractor shall perform with his own organization bid items amounting to not less than fifty (50) percent of the total contract cost. The percentage of the work to be performed shall be computed using the bid items as shown on the bid proposal and the unit prices as submitted by the contractor. No breakdown of the bid items will be allowed, such as breaking an excavation bid item into labor, equipment, fuel, etc. The unit prices used in the computation will be the bid price on the bid proposal, not the price the contractor is to pay the subcontractor. The contract value of items so designated as specialty items in the contract by the Special Provisions when subcontracted may be deducted from the total contract price before computing the amount of work required to be performed by the prime contractor.

e. A subcontractor may not subcontract any portion of his work.

5. The proposal guaranty, whether check or surety bond, of the low bidder will be retained by the City until the contract has been executed, all insurance requirements met, and satisfactory contract bond furnished. If the proposal guaranty is a check, it will then be returned to the low bidder. The proposal guaranty of the second low bidder will be retained until the City has determined that the award will not be made to them at which time the proposal guaranty will be returned if it is a check. If errors or irregularities appear in the proposal of either of the apparent low and second low bidders which create doubt as to the status of such proposal, the proposal and guaranties will be retained for all bidders until such time that the low bidder has been definitely established, any checks submitted as a proposal guaranty by the other bidders will then be returned. Any surety bond furnished as a proposal guaranty will be returned only upon request of the bidder furnishing it. If an award is not made, all checks submitted as a proposal guaranty will be returned to the bidders.

6. The individual, partnership, corporation or joint venture awarded the contract shall return the prescribed copies of the contract, bond and insurances, properly executed, to the office of the Director of Public Works within 10 days after the contract has been mailed to the bidder. No proposal shall be considered binding upon the City until the successful bidder has executed and returned the contract, a satisfactory bond, and the required insurances. No contract shall be considered effective until it has been fully executed by all of the parties hereto.

7. Failure to execute the contract and file acceptable bond and insurances within 10 days after the contract has been mailed to the bidder shall be just cause for the cancellation of the award and the forfeiture of the proposal guaranty. Award may then be made to the next lowest responsible bidder, or the work may be re-advertised and constructed under contract or otherwise, as the City may decide.

C. Scope of Work

1. The intent of the contract is to provide for the construction and completion in every detail of the work described. The contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

2. The City reserves the right to make, at any time during the progress of the work, without notice to the surety, such increases or decreases in quantities up to 25% of the total contract price for the project and such alterations in the details of construction, including alterations in the grade or alignment of the improvement or structure or both as may be found necessary or desirable. Plan changes may include the addition, elimination, reduction, or increase of anyone or more items or units. If the plan change results in the increase or decrease of the quantity of a major item by more than 25 percent, the City or the contract or may require negotiation of the unit price for that portion of the major item above 125 percent or below 75 percent of the quantity stated in the Contract. A major item, for the purpose of this Section, will be considered to be single bid items or if noted elsewhere a group of items or separate schedules, the total cost of which exceeds 15 percent of the total contract price for the project. If the City and the contractor cannot agree upon a unit price within ten (10) calendar days, the contractor shall immediately proceed to perform the work asset out in Section C-8 (Extra Work and Force Account) of this chapter. For Contract plan changes involving work for which there is no unit price, City and contractor shall, if possible, agree on a fair unit price or sum to be added to or deducted from the Contract, as appropriate. If a unit price or sum cannot be agreed upon within ten (10) calendar days, the contractor shall immediately proceed to perform the work asset out in Section C-8 (Extra Work and Force Account) of this chapter.

3. Precautions shall be exercised at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws and building and construction codes shall be observed. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with safety provisions for protection of the public as contained in the Occupational Safety and Health Administration Regulations. Contractor shall conduct the work at all times so as to cause no more obstruction or inconvenience to the public than is deemed necessary by the Director of Public Works or Owner. Free passage for vehicles and pedestrians shall be maintained by the contractor, at his expense, along roadways, sidewalks and drives, by bridging, if necessary, where it is practical to do so. Where bridging is unnecessary or impractical in the opinion of the Director of Public Works, the contract or may arrange for the diversion of traffic as herein after provided. If the contractor is required to maintain traffic over the project, he shall maintain the roadbed substantially free of ruts, holes, and detrimental surface deformations. Free access shall be provided to all fire hydrants, water and gas valves and fire alarms.

4. Control of Traffic

   a. The contractor shall provide for a sufficient number of warning lights, signs, and barricades, to be available on the worksite or as shown in the plans and shall cause them to be placed in such numbers and at such locations as required to maintain

reasonable safety to pedestrians and vehicular traffic. If it becomes necessary to divert traffic, a detour route shall be selected by the Director of Public Works and the contractor shall place at his expense or as provided for in the Contract, directional signs of such nature and in sufficient numbers to clearly define the detour route. All signing, drums, lights, and barricades shall conform to the Manual on Uniform Traffic Control Devices latest edition published by the Federal Highway Administration, including any revisions thereto, and the plans sheets.

b. Contractor shall be responsible for providing and maintaining all traffic control devices and flaggers as necessary to protect the project area and safeguard and direct traffic around their work, and to provide detours as shown on the detour plan provided. Signs and barricades shall be properly maintained during the time the construction project exists and must be modified if determined necessary by the Director of Public Works or Owner. They shall remain in place only as long as they are needed and shall be removed immediately thereafter. Where operations are performed in phases, there shall be in place only those devices that apply to the conditions present during the phase in progress. Signs that do not apply to existing conditions shall be removed, covered, folded, or turned so as to not be readable by oncoming traffic.

c. The City reserves the right to remedy any neglect on the part of the contractor as regards public convenience and safety which may come to its attention after twenty-four (24) hours notice in writing to the contractor; and failure of the contractor to correct such neglect, save in cases of emergency, in which the City shall have the right to remedy any neglect without notice. In either case, the cost of such work done by the City shall be paid by the contractor to the Office of the Director of Public Works prior to final payment or shall be deducted from final payment.

5. Protection of Public and Private Utilities

a. The contractor shall be responsible to support, sustain, and protect all existing privately and publicly owned utilities including but not limited to pipes, conduits, cables, poles, wires, handholes, fiber optic facilities, meters, valves, manholes, service lines, signs, markers, or other apparatus under, over along, across, or otherwise affected by the work.

b. The contractor shall make every effort to locate all utilities by contacting the Missouri One Call System, by contacting the owners of the utility, by prospecting, or otherwise in advance of any excavation operations. Certain pipelines, water mains, gas mains, sanitary sewers, and other existing underground and above ground installations and structures in the vicinity of the work to be performed hereunder are indicated on the plans according to the information made available to the City. The City does not guarantee the accuracy or completeness of such information, however. The failure of the City to show such utilities on the plans shall not relieve the contractor of his responsibility for the preservation and protection of such utilities.

c. The contractor will be solely responsible for any or all damages whether direct, indirect, or consequential to underground or above ground utilities and the surroundings, and shall indemnify and hold harmless the City, or the Owner for any and all claims or judgments whenever made as a result of his actions.

d. If existing utilities are damaged through carelessness or neglect of the contractor, they shall be repaired by the authorities having control over the same. Costs for these repairs will be paid by the contractor.

e. The contractor shall coordinate his operations with the affected utility agency that is making necessary adjustments, relocations, removals, or construction of new fixtures and shall permit free access to the site for such work. It is understood and agreed that the contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions whether or not they are shown on the plans and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by the contractor due to any conflict or interference from the said utility appurtenances or the operation of moving them. If the owners of utility facilities fail to cooperate and coordinate their work with that of the contractor and that failure results in actual delay to the contractor in the overall completion of the project, such delay will be considered in the time specified in the contract for completion, provided the contractor notifies the Director of Public Works of the delay at the time it occurs.

6. Damage to Private Property

a. The contractor shall confine his work to the City's premises, including easements and construction permit areas. He shall not enter upon or place materials on any private premises except by written consent of the individual owners, and he shall hold the City harmless from all suits and actions of every kind and description that might result from his use of private property. Any work outside of the easements or right-of-way shown could be considered trespassing.

b. The contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by the construction work performed by him. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures affected by construction operations in connection with the performance of the contract, together with all sod and shrubs in yards and parking areas crossed by, or adjacent to, the construction limits, shall be maintained and, if removed or otherwise damaged, shall be restored to the original condition whether within or outside the easement. All replacements of such underground construction and surface structures, or parts thereof, shall be made with new materials conforming to the requirements of these specifications or, if not specified, as approved by the Department of Public Works.

c. The contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property or facility, regardless of location of character, which may be caused by moving, hauling, or otherwise transporting equipment, materials, or men to or from the work or any part or site thereof whether by him or his subcontractors. The contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

d. No fence outside the right-of-way or easement limits shall be removed without the prior written consent of the owner of the lot or tract of land on which such fence is located.

e. The contractor shall cause all lot corner pins disturbed by his operation to be reset by a registered land surveyor and will on completion of the work file with the City a certificate from the survey or that said pins have been reset.

7. Drainage structures at driveways, private entrances, and street intersections which must be removed during the normal prosecution of the work called for in the contract shall be deemed the property of the City of Farmington. The contractor shall use reasonable care in the removal of all drainage structures and stack them for salvage by the City. Should the City not wish to claim such drainage structures, the contractor will be required to remove them from the job site. It will be the contractor's responsibility to notify the City that said structures are available for salvage and upon the expiration of three (3) working days of such notice, if the City has not removed said drainage structures from the site of the work, it shall be deemed that the City has relinquished all claim to said drainage structure.

8. Extra Work and Force Account

a. The contractor shall perform unforeseen work, for which there is no provision included in the contract, whenever it is deemed necessary or desirable to complete the work as contemplated. Such work shall be performed in accordance with the specifications and as directed by the Director of Public Works.

b. Payment for extra work will be based on lump sum or unit prices previously agreed to in writing by the parties to the contract or the City may require the contractor to do such work on a force account basis.

c. Force account work will be compensated in the following manner:

1. The contractor will receive the rate of wage paid by him for each hour that all labor is engaged in such work. The contractor will receive the actual costs paid to, or in behalf of, employees by reason of health and welfare benefits, pension fund benefits or other benefits required by an employment contract. An additional amount equal to 35 percent of the sum of the above items will also be

paid to the contractor. No separate payment will be made for insurance premiums, unemployment insurance contributions and social security taxes as compensation for these costs will be considered as fully covered in the 35 percent figure stated above.

2. The contractor will receive the actual cost of materials accepted by the Director of Public Works and used in the work; including transportation charges paid by the contractor. An additional amount equal to 15 percent of the material and transportation cost will also be paid to the contractor. No compensation will be allowed for materials, such as forms, which are used in connection with, but do not enter permanently into the work.

3. For any equipment necessary to the work, including all fuel and lubricants, tires, and repairs, the contractor will be allowed the hourly rental rates set out in the "Rental Rate Blue Book for Construction Equipment" on file in the Public Works Department at the time the work is done. The allowed rates will be the sum of the bare hourly rates and the estimated operating cost per hour. The allowed time for the hourly rental rates will include that required to move the equipment to and from the site of the force account work plus the actual operating time on the work. If the actual unit of equipment is not listed in the schedule, the rate listed for similar equipment shall be used.

4. The Director of Public Works has the authority to require alterations in the equipment and labor force assigned the force account work, to limit authorization of overtime or to require overtime work when an emergency exists.

5. No allowance will be made for general superintendence, the use of small tools or equipment or other costs not specifically herein provided. All subcontractors will be considered employees of the contractor.

6. Each day the contractor's representative and the Director of Public Works shall compare records of the cost of the force account work and the agreed upon record shall be signed by both the Director of Public Works and the contractor. No payment will be made for the force account work until the contractor has furnished the Director of Public Works with itemized statements of cost of such work.

D. Control of Work

1. Authority of the Director of Public Works

a. When work is being performed under direct contract with the City of Farmington, the Director of Public Works, or his duly authorized representative will decide all questions which may arise as to the quality, quantity and accept ability of materials furnished and work performed. The decisions of the Director of Public Works as to the intent of the contract, plans, specifications and estimates, and as to all questions

arising as to the acceptable fulfillment of the contract on the part of the contractor; all questions of classification; the proper compensation for the performance or breach of the contract; all claims of any character whatsoever in connection with or growing out of the construction whether claimed under the contract, under force account, under quantum merit, or otherwise; shall be final, binding, and conclusive upon all parties to the contract.

b. The Director of Public Works, or his duly authorized representative, has the authority to suspend work being performed on City rights-of-way, wholly or in part for such period or periods as he may deem necessary due to the failure of the contractor to correct conditions unsafe for the workmen or general public.

c. In case of failure on the part of the contractor to execute work ordered by the Director of Public Works, the Director of Public Works may, at the expiration of a period of 48 hours after giving written notice tc the contractor, proceed to execute such work as may be deemed necessary, and the cost thereof shall be deducted from compensation due or which may be come due the contractor under the contract.

d. When work is performed on City rights-of-way in conjunction with private improvements, all work will be inspected by the Department of Public Works to ensure conformity to these General Conditions and Technical Specifications. The Director of Public Works will decide all questions which may arise as to the quantity of materials furnished; work performed as to the acceptable rate of progress; all questions as to the acceptable fulfillment of the intent of the plans. The Owner and/or his Engineer will also be responsible for resolving any conflicts between the plans and existing site conditions; any conflicts between the plans and the construction staking; and any conflicts between constructability of the plan and these specifications and site conditions.

e. Nothing contained in this section or in the contract shall be construed as requiring or permitting the Director of Public Works, or his duly authorized representative, to direct the method or manner of performing any work at a jobsite.

2. Authority and Duties of the Inspectors

a. The Director of Public Works may appoint inspectors as assistants to inspect all materials used and all work performed within the City's rights-of-way. Such inspection may extend to any or all parts of the work and to the preparation or manufacture of the materials to be used. The inspectors will not be authorized to revoke, alter, enlarge or relax the provisions of the specifications whether or not the work is being performed in accordance with a City Contractor for a private development.

b. An inspector will not be authorized to approve or accept any portion of the work or to issue instructions contrary to the plans and specifications. The inspector will have authority to reject defective material and to suspend any work that is being

improperly done, subject to the final decision of the Director of Public Works. The inspector will exercise such additional authority as may, from time to time, be especially delegated to him by the Director of Public Works.

c. An inspector will call to the attention of the contractor, whether by contract with the City or by private development, any lack of compliance with the plans or specifications. However, failure of an inspector or the Director of Public Works to call the attention of the contractor to the faulty work, or lack of compliance with the plans and specifications, shall not constitute acceptance of said work.

d. When an inspector is assigned to the work being performed in conjunction with a private development, the inspector will only inspect and approve the public infrastructure portion of the work performed to ensure compliance with these General Conditions and Technical Specifications.

e. When an inspector is assigned to the work being performed in conjunction with a City Contract, the inspector will keep the Director of Public Works informed as to the progress of the work and the manner in which it is being accomplished.

3. The Director of Public Works must approve all plans for public improvements within the City of Farmington. This approval is a conceptual approval only and does not give detail approval to any particular design item or data shown on the plans, nor does it give approval for any deviation from City specifications unless that deviation is shown on the plans by a general note and has prior written approval. The Registered Professional Engineer or Architect who sealed the plans is responsible for all lines and grades, field data, constructability of the design and all other items affecting the project including compliance with the City specifications.

4. Working drawings for structures within the City rights-of-way or easements shall be furnished by the contractor and shall consist of such detailed plans as may be required to adequately control the work and which are not included in the plans furnished by the City. Required working drawings must be approved by the Director of Public Works and such approval shall not relieve the contractor of any of his responsibility under the contract for the successful completion of the work. The contract price will include the cost of furnishing all working drawings.

5. All work performed and all materials furnished shall be in conformity with the lines, grades, cross sections, dimensions, and material requirements, including tolerances, shown on the plans or indicated in the specifications.

a. If the Director of Public Works finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications but that reasonably acceptable work has been produced, he will then make a determination as to whether or not the work will be accepted and remain in place. If accepted, the Director of Public Works will document the basis of acceptance by contract modifications which may provide for an appropriate adjustment in the contract price

for such work or materials as he deems necessary to conform to his determination based on engineering judgment.

b. If the Director of Public Works finds the materials or the finished product in which the materials are used or the work performed have resulted in an unacceptable product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the contractor.

6. The contractor shall take no advantage of any apparent error or omission in the plans or specifications. If the contractor discovers such an error or omission, he shall immediately notify the Director of Public Works. The Director of Public Works will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

7. The contractor shall give the work the constant attention necessary to facilitate the progress thereof and shall cooperate with the Director of Public Works and other contractors in every way possible. The contractor shall conduct his work so as not to interfere with or hinder the progress or completion of the work being performed by other contractors or utilities. The contractor shall schedule his work and shall place and dispose of the materials being used so as not to interfere with the operations of other contractors. Pavements over which hauling is performed shall be kept clean of spilled or tracked on materials at all times.

8. The contractor shall furnish the Director of Public Works with every reasonable facility for ascertaining whether or not the work is performed in accordance with the requirements and intent of the plans and specifications. Any work done (except excavation) or material used without suitable supervision by the contractor or inspection by the Director of Public Works may be ordered removed and replaced at the contractor's expense. The contractor shall also provide reasonable access and inspection of the project site and work being performed to representatives of the Federal Government, Missouri Highway Commission, Missouri Department of Natural Resources, Ste. Francois County, and City of Farmington.

9. No construction work shall be done during stormy, freezing or inclement weather, except as can be done satisfactorily and in accordance with applicable specifications and with the approval of the Director of Public Works. This provision will not be justification for time extensions on calendar day contracts.

10. When it becomes necessary to close a street, the contractor shall notify the Director of Public Works at least seven days in advance of such closure including information as to the exact location and extent, the time and expected duration and the reason for the closure. If, in case of an emergency, it becomes necessary to close any street without advance notice, the contractor shall immediately notify the Police and Fire Department and advise the Director of Public Works of such closure.

11. All work which has been rejected or condemned shall be repaired, or if it cannot be repaired satisfactorily, it shall be removed and replaced at the contractor's expense. Defective materials shall be immediately removed from the site of the work. Work done without line and grade having been given, work done beyond the lines or not in conformity with the grades shown on the plans, work done without proper inspection, or any extra or unclassified work done without written authority and prior to agreement in writing as to prices, shall be considered as unauthorized work and done at the contractor's risk. All work considered unauthorized, at the option of the Director of Public Works, may not be measured and paid for, and may be ordered removed at the contractor's expense. Upon failure of the contractor to repair satisfactorily or to remove and replace rejected, unauthorized, or condemned work or materials immediately after receiving notice to the contractor, the City has the authority to cause unauthorized work to be removed. The cost of such work shall be paid to the Office of the Director of Public Works prior to final payment or shall be deducted from final payment.

12. Where the work passes over or through private property, easements or right-of-way are as shown on the plans. Any work outside of the easements or right-of-way shown could be considered as trespassing. The contractor shall notify the proper representatives of any public utility, any corporation, any company or any individual, not less than two (2) working days in advance of any work which might damage or interfere with their property or operation along or adjacent to the work. The contractor shall be responsible for any damage or injury to property of any character by reason of any negligent act or omission on the part of the contractor or the contractor's employees or agents, or due to defective work or materials, or due to his failure to reasonably or properly prosecute the work. When and where any such damage or injury is done to public or private property on the part of the contractor, he shall restore or have restored at his own cost and expense such property to a condition equal to or exceeding that existing before such damage was done, by repairing or otherwise restoring as may be directed, or he shall make good such damage from injury in a manner acceptable to the Director of Public Works. In addition to the above, the contractor shall, unless otherwise indicated on the plans: (1) Cause any fences upon the real estate that may be damaged or destroyed to be removed and replaced; (2) Cause any bushes, flowers or shrubbery upon the real estate to be removed and replaced when necessary to avoid destruction or injury, covenanting only to use reasonable care to preserve the life and condition of same; (3) Cause any excavation upon the real estate to be backfilled and graded to the original grade; (4) Remove, in so far as reasonably possible, all debris resulting from construction, including rock; (5) Cause the re-seeding of any disturbed area; (6) Preserve, in so far as reasonably possible and where it will not unreasonably interfere in the progress or the completion of the work, the life and condition of any tree upon the real estate; (7) Provide during construction reasonable access to the public street where any excavation upon the real estate might otherwise interfere therewith; (8) Replace any improved walkway, drive or retaining wall damaged or destroyed by construction; and (9) Cause all lot corner pins disturbed by his operation to be reset by a registered land surveyor, and will file with the City a certificate from the surveyor that said pins have been reset. In case of failure on the part of the contractor to restore such property or make good such damage or injury, the Director of Public Works may, upon forty-eight (48) hours

written notice, under ordinary circumstances and without notice when a hazardous condition results, proceed to repair, rebuild or otherwise restore such property as may be determined necessary, and the cost thereof shall be paid to the City prior to final payment or shall be deducted from final payment.

13. The contractor shall have on the project at all times, as his agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed who shall receive instructions from the Director of Public Works or his authorized representatives. The superintendent shall have full authority to execute orders or directions of the Director of Public Works without delay, and to promptly order such materials, equipment, tools, labor, and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work sublet.

14. A written Notice to Proceed shall be given to the contractor for each project let by the City. This notice shall set forth the beginning of the project calendar days or the date for completion.

15. If either party has a claim against the other which in any way arises out of the provisions of the contractor the performance or non-performance thereunder, written notice of such claim must be made in triplicate prior to the expiration of 60 days after delivery by the City to the contractor of a check or draft for the retained percentage. If the claim is against the City the notice of claim must be personally delivered or sent by certified mail to the Office of the Director of Public Works. If the claim is against an assignee, notice of the claim must be personally delivered or sent by certified mail to the assignee at the address shown on the accepted notice of the assignment. Within 60 days after the receipt of notice of any claim, the party against whom the claim is made shall make any claim he has against the other party. All notices of claims must contain an itemized statement showing completely and fully the items and amounts forming the basis of the claim. Any claim or an item of any claim not included in the notice and statement, or any claim included but not clearly defined and specifically set out and itemized, or any claim not filed within the time and in the manner provided above shall be forever waived and shall neither constitute the basis of nor included in any legal action, counter-claim, set-off, or arbitration between the parties.

E. Control of Material

1. All material needed in the work shall be furnished by the contractor unless otherwise stated in the contract. The contractor shall assume full responsibility for ordering materials of the quality and quantity required. When requested by the Director of Public Works, the contractor shall promptly furnish for approval samples, certificates of tests, or certifications of compliance with the specifications of materials proposed for use in the work. Only materials conforming to the quality requirements of the contract shall be used in the work. Any materials proposed to be used in the work may be inspected or tested at any time during production, manufacture or use. If, at any time, it is found that a source of supply does not furnish a uniform product, or if the product from any source

proves unacceptable, the contractor shall immediately make such adjustments as are necessary to furnish approved materials from that source, or shall furnish approved materials from other sources. Any work incorporating materials which have not had prior approval of the Director of Public Works shall be performed at the contractor's risk and may be considered as unacceptable and unauthorized and, if so considered, will not be paid for.

When certifications are requested, three (3) copies of the certification shall be provided and each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company, shall be notarized, and shall contain the name and address of the contractor, the project name and location, and the quantity and the date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of tests to which there port applies. Certification shall not be construed as relieving the contractor from furnishing satisfactory material if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

When a specification of a national standard (ASTM, AASHTO, AWWA, etc.) is designated herein or in the contract documents, the materials shall meet the requirements of the latest revision of the designated specification. Tests of samples of materials shall be made in accordance with the latest method prescribed or in the absence of a prescribed method; tests will be performed in a manner as determined by the Director of Public Works.

2. The Director of Public Works or personnel of a laboratory designated by him shall be permitted free access to all parts of the work as necessary for adequate inspection and selection of samples. Every reasonable facility shall be furnished by the contractor for assistance in the performance of tests and for the protection of testing equipment and supplies used in the performance of testing work.

request and/or shall, at no cost to the City, furnish for approval such representative samples of material proposed for use in the work as the Director of Public Works may request, and shall ship such samples prepaid to such persons and addresses as the Director of Public Works may order. Samples shall be shipped so as to allow ample time for testing without delaying the work. No material for which samples are requested shall be used until the samples have been approved.

Field sampling and testing of materials will be made by the Director of Public Works or personnel of a laboratory designated by him in accordance with the applicable standards prescribed above. Testing shall be done at the expense of the City, unless otherwise stated in the Special Provisions.

F. Legal Relations and Responsibility to the Public

1. The contractor shall at all times observe and comply with all Federal and State laws, local laws, ordinances, decrees, and regulations existing at the time of or enacted subsequent to the execution of the contract which in any manner affect the prosecution of the work. The contractor and his surety shall indemnify and save harmless the City and all of its officers, engineers, representatives, agents, and employees against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the contractor, his employees, or his subcontractors.

   a. On projects involving Public Works or Public Funds, it is the statutory policy of the State of Missouri that "a wage of no less than the prevailing hourly rate of wages for work of a similar character in this locality as established by the Department of Labor and Industrial Relations, in which the work is performed, shall be paid to all workmen employed by or on behalf of any public body, engaged in Public Works, exclusive of Maintenance work."

   b. In compliance with Missouri State Law, the following stipulations are made a part of this contract.

      1. The schedule of occupational classifications and minimum hourly wage rates applicable to the particular project are enumerated in and made a part of the contract documents.

      2. The contractor shall forfeit as a penalty to the State, county, city and county, city, town, district or other political subdivision on whose behalf the contract is made or awarded, $100.00 for each workman employed, for each calendar day, or portion thereof, such workman is paid less than the said stipulated rates for any work done under this contract, by him or by any subcontractor under him.

      3. All bonds furnished by this contractor shall include such provisions as will guarantee the faithful performance of the prevailing hourly wage clause as provided by this contract.

      4. A clearly legible statement of all prevailing hourly wage rates to be paid all workmen employed in order to execute this Contract shall be kept posted in a prominent and easily accessible place at the site of the work by each contractor and subcontractor engaged on this project, and such notice shall remain posted during the full time that any workmen shall be employed on the project.

      5. Wage interviews of the contractor's and subcontractors' workforce will be made at random intervals to verify that the prevailing wage rate is being paid. If at any time the City determines that prevailing wages are not being paid, the City reserves the right to withhold and / or delay progress payments until the situation is corrected by the contractor. In addition to random on site wage interviews, the contractor and each subcontractor is requested to submit weekly payrolls for the complete contract period.

6. Before final payment can be made for this project, the bonding company is to be notified that all work has been accepted and final payment is to be made. Also, the contractor must file an affidavit stating that he has fully complied with the Prevailing Wage Law and discharged all indebtedness. No final payment can be made unless this affidavit is filed in proper form and order.

The contractor shall be held to comply with all requirements of the Prevailing Wage Law included in Chapter 290 of the Revised Statues of Missouri.

c. When the United States Government pays all or any portion of the cost of a project, the Federal laws, and the rules and regulations made pursuant to such laws, shall be observed by the contractor, and the work will be subject to the inspection of the appropriate Federal agency. When Federal wage rates are applicable and included, the contract is subject to the "Work Hours Act of 1962" (P.L. 87 - 581; 76 Stat. 357) and implementing regulations and any amendments thereto.

2. The contractor shall procure all permits and licenses, shall pay all charges and fees, and shall give all notices necessary incidental to the due and lawful prosecution of the work. The contractor shall be required to have a current Occupational License from the Finance Department of the City of Farmington. The cost of complying with these requirements will be included in the contract unit price for other items.

3. The contractor shall not discriminate on the grounds of race, creed, color, national origin or ancestry, sex, religion, handicap, or political opinion or affiliation against any employee of the contractor or applicant for employment, and shall comply and cause his subcontractors if any, to comply with all local, state and federal laws, regulations, and directives against discrimination in connection with the project. Such nondiscrimination requirements extend to procurement of materials and lease of equipment for use in connection with the project.

4. If the contractor is required or desires to use any design, device, material, or process covered by letter patent or copyright, he shall arrange and provide for such use by suitable agreement with the patentee or owner, and a copy of the agreement may be required by the City. The contractor shall indemnify and save harmless the City from any suits, claims, or damages arising from the infringement upon or use of any patented or copyrighted design, device, material, or process.

5. The contractor shall at all times take necessary precautions to protect the life and health of all persons employed on the project. He shall familiarize himself with the latest accepted accident prevention methods and provide necessary safety devices and safeguards in accordance therewith. The City will refuse to provide inspection service at plants or worksites where adequate safety measures are not provided and maintained.

a. The contractor and all subcontractors to the contract must require all onsite employees to complete the ten-hour Occupational Safety and Health Administration

(OSHA) construction safety training program required under Section 292.675, RsMO, unless they have previously completed the program and have documentation of having done so. The training course shall be approved by OSHA or be a similar program approved by the Missouri Department of Labor & Industrial relations that is at least as stringent as an approved OSHA program. All employees are required to complete the program within sixty (60) days of beginning work on such construction project. Any employee found on the worksite without documentation of the successful completion of such a course shall be afforded twenty (20) days to produce such documentation before being subject to removal form the project. If any employee fails to complete the program within sixty (60) days of the start of the project or within twenty (20) days of being found on the worksite without documentation, the contractor shall forfeit as a penalty to the City two thousand five hundred dollars ($2,500) plus one hundred dollars ($100) for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

b. 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 Missouri Department of Natural Resources or of other bodies or tribunal shaving jurisdiction over public health and sanitation. No public or private nuisance shall be permitted.

c. All sanitary facilities and safety devices shall be furnished free to employees and the cost to the contractor will be considered covered under the various items of the contract documents.

d. The contractor's employees and the subcontractor's employees shall conduct themselves in action and language in a moral manner or the City will order the work stopped until the employee or employees are removed (or the situation is corrected).

6. Preservation of Monuments and Artifacts

a. The contractor shall not disturb or damage any land monument or property landmark until authorized by the Director of Public Works.

b. The contractor shall be responsible for the preservation of all artifacts, fossils, and other items or archaeological or geological significance discovered within the right-of-way during his operations, and shall handle such items in accordance with applicable laws and regulations. When remains of prehistoric sites or artifacts of historical or archeological significance are encountered, the excavation operations shall immediately be temporarily discontinued and the Director of Public Works shall be contacted. The Director of Public Works will determine the disposition of such sites or artifacts. When directed by the Director of Public Works, the contractor shall excavate the site in such manner as to preserve the artifacts encountered.

7. The contractor shall take sufficient precautions to prevent pollution of streams, lakes, ponds, sinkholes and reservoirs, with fuels, oils, bitumens, calcium chloride, or other harmful materials. The contractor shall schedule and conduct his operations so as to avoid or minimize siltation of streams, lakes, ponds, sinkholes, and reservoirs. In areas particularly subject to erosion, the contractor shall, subject to the approval of the Director of Public Works, conduct his operations in such manner to reduce exposure of the uncompleted portions of the project to the shortest time practicable.

8. The contractor shall indemnify and save harmless the City, its officers, agents and employees from all claims or suits made or brought for injury to persons or property caused by the contractor's negligence or his failure to perform the work in accordance with the plans and specifications. The City may retain from any payment due or to become due the contractor such sums as are deemed necessary to protect the City's interests until all such claims or suits have been settled or disposed of and suitable evidence to that effect furnished to the City.

   In the event that a citizen makes a claim against the contractor or subcontractor, then the contractor shall do the following:

   a. Investigate a claim within a reasonable period of time when notified by a citizen or the City of Farmington.

   b. Within 5 days after completing the investigation, the contractor shall notify in writing the person making the claim that the contractor is approving or denying the claim or a part thereof. The City shall receive a copy of the written notification.

   c. Assure that claims shall not be denied for frivolous reasons.

   In the event the City of Farmington determines after notification by a citizen that the contractor has failed to comply with the above provisions and after notifying the contractor and determining that the contractor has failed to comply with the above provisions, the City of Farmington may, in its direction, withhold payment to the contractor until the provisions set forth above are complied with.

9. When explosives are used in the prosecution of the work, the contractor shall follow federal, state, county, and municipal laws and regulations pertaining to the use and storage of explosives for rock and earth excavation. All explosives shall be stored and used in a safe manner and in compliance with all existing statutes and ordinances and all places used for such storage shall be marked clearly "DANGEROUS EXPLOSIVES." The contractor must obtain a separate permit from the City of Farmington for each job and obtain a special conditions permit from the City of Farmington if blasting within 150 feet of a well. The contractor shall be responsible for providing a copy of the City permits and conducting pre-blast surveys when blasting within congested areas or within 350 feet of any structure, well, railway, road, highway, or other installation before any blasting can occur on a project site.

The contractor shall take precautions to minimize earth vibrations and air blast effects and shall use blasting mats or other protective means to prevent fragments from being thrown. In addition, a) No fly rock shall leave the immediate area, b) A minimum of one seismograph shall be used on all blasting areas and the inspector may require more depending on the surrounding area congestion, c) Seismic readings shall not exceed 1.0 inches per second at the closest structure or well, d) Monthly seismic readings and copies of the blasting log shall be provided to the inspector and Fire Official, unless more frequent readings and logs are requested, and e) Sound levels shall not exceed 140 decibels at the seismic area.

Blasting periods shall be limited to normal daylight hours. Except by special agreement with the Director of Public Works, these hours shall be limited to between 9:00 a.m. and 4:00 p.m. each working day. In addition, the contractor shall as a minimum provide the following warnings before each blast:

a. a. The blasting contractor or facility operator shall be responsible for ensuring that the blast area is visually inspected and made clear of people and/or animals before each shot.

b. Three (3) 5 to 10 second soundings from a siren, air horn, or other approved warning device, with a minimum sound level of 140 decibels at one hundred (100) feet shall be sounded.

c. WAIT a full thirty (30) seconds.

d. Sound another 5 to 10 second sounding.

e. Immediately following the two (2) 5 to 10 second soundings, give a VOICE COMMAND from an amplified bullhorn or equal stating "DETONATION TO FOLLOW."

f. No person shall enter the blast area until such time that the blaster in charge has determined that no danger exists.

g. An "ALL CLEAR" voice command shall be given after the blast and when the blast area is safe to enter for inspection.

The contractor shall save the City and its agents, officers, and employees harmless from any claim arising out of the use of such explosives. Removal of any item or material of any nature by blasting shall be done in such manner at such time as to avoid damage affecting the integrity of the design and to avoid damage to any new or existing structure included in or adjacent to the work. Unless the plans, special provisions, or the Director of Public Works restricts such operation, it shall be the contractor's responsibility to determine a method of operation to insure the desired results and the integrity of the completed work. Blasting will not be permitted until the contractor has obtained proper

insurance (see Sec. F-12.b of this chapter) and has obtained a permit from the City Fire Department.

It shall be the responsibility of the contractor to notify each public utility company, having structures or service in proximity of the site of work, four (4) working days before any blasting can take place. It is the contractor's responsibility to protect all structures from damage or to repair or replace those structures at his own expense.

If during the course of the blasting program a complaint is lodged, or a claim for damage stated, a post-blast inspection shall be conducted on the property in question. The post-blast inspector should investigate each complaint or claim thoroughly, and using, where appropriate, the pre-blast inspector's report to compare pre-existing damages with those being claimed. The post-blast inspector should in no way make either comment or commitment to the complainant or claimant. The contractor shall furnish the inspector two copies of the complete investigation and status of the claim within two weeks of being notified of the complaint or claim.

No additional payment will be made for blasting or complying with all the blasting laws, regulations, or these requirements.

10. Until the work is accepted by the City, it shall be in the custody and under the charge and care of the contractor. The contractor shall rebuild, repair, restore, or make good, at his expense, any lost or stolen City-owned material, and all injuries or damages to any portion of the work before its completion and acceptance, caused by the action of the elements or from any other reason. Issuance of a pay estimate on any part of the work done will not be considered as final acceptance of any work completed up to that time. The City may, in its discretion, make such adjustment as it considers to be proper for damage to the work due to unforeseeable causes beyond the control of the contractor, and without fault or negligence on the part of the contractor.

11. The contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as contractor is for the acts and omissions of persons it directly employs. Contractor shall cause appropriate provisions to be inserted in all subcontracts relating to the work, to bind all subcontractors to contract or by all the terms set forth in the contract with the City in so far as applicable to the work of subcontractors, and to give the contract or the same power regarding termination of any subcontract as the City may exercise over contractor under any provision of the contractor contract documents. Nothing contained in the contract shall create any contractual relation between any subcontractor and the City or between any subcontractors.

12. The contractor and/or the subcontractor responsible to the general contractor, shall furnish evidence of insurance to the City of Farmington by means of a certificate properly executed by a qualified agent or representative of the insurance company for the following types of coverages: (The insurance policy must be furnished to the City prior to approval of the contract for the coverage required under Paragraph e).

a. Worker's Compensation Insurance for all of its employees to be engaged in work under the contract, in the amount required by statute.

b. Manufacturer's and Contractor's Public Liability Insurance, and Contractor's Property Damage Insurance by accompany duly licensed and qualified to do business in Missouri by the Missouri Insurance Department. The limits of liability shall be in an amount not less than two million dollars for all claims arising out of a single occurrence and three hundred thousand dollars for anyone person in a single accident or occurrence, except for those claims governed by the provisions of the Missouri Workmen's Compensation Law, Chapter 287, RSMO, and Contractor's Property Damage Insurance in an amount not less than two million dollars for all claims arising out of a single occurrence and three hundred thousand dollars for anyone person in a single accident or occurrence. Blasting operations shall not be performed unless and until the contractor has obtained and furnished to the Director of Public Works a certificate of blasting coverages properly executed by a qualified agent or representative of the insurance company. In case the insurance company has no local agent, a facsimile certificate may be accepted. If the general contractor has furnished satisfactory evidence of insurance as prescribed above with a properly executed certificate of insurance indicating his complete responsibility for all damages normally covered under a standard liability policy, then it will not be necessary that his subcontractors furnish evidence of all coverages prescribed above as the general contractor will be held completely responsible for the acts of his employees and/or subcontractors.

c. Automobile Liability Insurance will be required of all contractors and/or subcontractors performing work for the City of Farmington and evidence of proper coverage will be required through a certificate by a duly authorized agent or representative of a company authorized to do business in Missouri by the Missouri Insurance Department. Limits of liability shall be in an amount not less than two million dollars for all claims arising out of a single occurrence and three hundred thousand dollars for anyone person in a single accident or occurrence.

   The policy must also specify that the contractor or his employees and/or the subcontractor's employees operating their own vehicles for business reasons applicable to the performance of their work whether or not involved in operations pertaining to the performance of the contract for the City, will be protected by a non-ownership and hired automobile liability policy with limits as described above for automobile liability and property damage.

d. All of the above coverages described pertaining to Worker's Compensation, Public Liability, Automobile Liability and Non-Ownership and Hired Car Liability requiring certificates of insurance to the City must specifically provide that "no changes of coverages will be made in the contract nor will any coverage be cancelled or altered without a thirty (30) day notice of cancellation of alteration being mailed to the Public Works Department, City of Farmington, Missouri by registered mail."

e. Owner's Protective Liability Insurance shall also be obtained by the contractor at its own expense and delivered to the City naming the City of Farmington as the insured with the same insurance company with which the Contractor carries his Contractor's Public Liability Insurance and Automobile Liability Insurance, in an amount not less than two million dollars for all claims arising out of a single occurrence and three hundred thousand dollars for any one person in a single accident or occurrence, except for those claims governed by the provisions of the Missouri Worker's Compensation Law, Chapter 287 RSMo; further, no policy will be accepted which excludes liability for damage to underground structures or by reason of blasting, explosion or collapse.

f. In case any of this work is subcontracted, the contractor shall require the Subcontractor to procure and maintain all insurance required in this section and in like amounts and provide copies of the insurance certification to the Public Works Department.

g. The insurance required under Sub-paragraphs b and c hereof shall provide adequate protection for the contractor and his subcontractors, respectively, against damage claims which may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by it, and also against any special hazards which may be encountered in the performance of this contract.

   NOTE: Subparagraph g is construed to require the procurement of contractor's protective insurance (or contingent public liability and contingent property damage policies) by a general contractor whose subcontractor has employees working on the project, unless the general public liability and property damage policy (or rider attached thereto) of the general contractor provides adequate protection against claims arising from operations by anyone directly or indirectly employed by contractor.

h. The contractor and/or subcontractor shall furnish the City, prior to approval of the contract, the policy as specified in this section and satisfactory proof of carriage of all the insurance required by this contract.

i. The contractor agrees to defend, indemnify, and save the City harmless from and against all claims, suits and actions of every description, brought against the City and from all damage and costs by reason or on account of any injuries or damages received or sustained by any person or persons, or their property, by contractor, its servants, agents or subcontractors in the construction of said work, or by any negligence or carelessness in the performance of same, or on account of any act or omission if contractor, its servants, agents, or subcontractors, or arising out of the award of this contract to contractor.

j. Unless otherwise specifically indicated in the contract documents, no deductibles will be permitted with respect to any of the above described policies.

13. Protection of Traffic Signs

    a. The contractor shall notify the Director of Public Works 24 hours in advance before moving or removing any traffic sign.

    b. Any traffic sign the Director of Public Works allows to be removed and not immediately re-erected shall be stored by the contractors and maintained in the sign's original condition.

    c. Any sign or post damaged by the contractor shall be replaced immediately by the contractor.

14. Contractor shall ensure that all trenching in connection with the project shall conform with required standards under the Occupational Health and Safety Act. On any project requiring a trench excavation over four (4) feet in depth or in potentially unstable soil, the contractor shall appoint a trenching supervisor who shall serve as the contractor's representative responsible for the safety of all project trench excavations. The name and qualifications of the trench supervisor shall be furnished in writing to the Director of Public Works by the contractor. The contractor must certify to the City that the trench supervisor has been trained in and is knowledgeable concerning soil analysis, the use of trench bracing and supports, protective systems, and OSHA standards relating to trenches. The trench supervisor must be present at the excavation site and inspect the site during excavation. The trench supervisor shall remain on the construction site at all times during which workmen remain in the trench. The trench supervisor must be immediately available to access the trench site and must have authority from the contractor to stop construction, to order workers out of the trench, and to implement safety measures necessary to safeguard workmen using the trench. As used herein, a trench is defined as any narrow excavation made below the surface of the earth with a width not greater than 15 feet and ordinarily will be at a depth greater than its width. If trench boxes, forms, braces, or other structures are used in the excavation so that the distance between the forms and the bottom of the excavation wall are 15 feet are less, then the excavation will be considered a trench for the purposes of this paragraph. More than one trenching supervisor may be appointed by the contractor on any job where needed.

15. Contractor shall maintain dust control at all times. During dry periods, contractor shall use water to keep dust to a minimum. Contractor shall also keep all streets within or adjacent to the construction site free of any dirt carried on the street surface by construction vehicles or from site erosion. Cost for dust control and keeping street clear of dirt will not be a separate bid item. Cost shall be included in other bid items.

16. Access for mail delivery must be maintained during construction. It shall be the contractor's responsibility to provide the access and to temporarily relocate mailboxes if necessary in coordination with the postal system and residents. Replacement of mailboxes to their final location will be as shown on Standard Drawing ST-7 using a new, pre-made 4 X 4 mailbox post, unless property owner wants the existing wood or

metal post re-used. At apartments or where multiple mailboxes are encountered, the contractor shall carefully remove and relocate the mailbox units to the new location without damage. Contractor shall coordinate with property owners and post office concerning temporary and final mailbox locations. No direct payment will be made for costs associated with mailbox relocation, reconstruction, or access maintenance.

17. It is anticipated that storm, surface, and possible ground or other waters will be encountered at various times and locations during the construction process. Such waters may interfere with contractor's operation and may cause damage to adjacent or downstream private and/or public property by flooding, lateral erosion, sedimentation, or pollution if not properly controlled by the contractor. Any contractor working on City right-of-way or contracted with the City will be required to repair any and all damage caused by said waters. The contractor, by working on City right-of-way, assumes all said risk, and agrees to hold the City harmless.

18. The contractor shall furnish, install, and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required by the sanitary codes of the state and local government. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single-service containers or satisfactory types of drinking stands or fountains. All such facilities and services shall be furnished by the contractor at his sole cost and expense in strict accordance with existing and governing health regulations.

19. All water required for and in connection with the work to be performed and for any specified tests of sewers and manholes, for inundation or settling of back fill material, or for any other use as may be required for proper completion of the work shall be provided by and at the expense of the contractor. No separate payment for water used or required will be made and all costs in connection therewith shall be included in the bid.

20. All power for lighting, operation of the contractor's plant or equipment, or for any other use by the contractor, shall be provided by the contractor at his sole cost and expense.

G. Prosecution and Progress

1. The time for completion of the work is specified and is an essential part of the contract. The beginning of the time for completion of the work will be based upon the date established in the "Notice to Proceed." Time for completion will be expressed in calendar days or by a specific date. This time for completion has taken into account the normal number of days expected for inclement weather. The contractor will not be entitled for any extension of time due to unsuitable weather conditions.

2. The Director of Public Works may make allowance for time lost due to causes which, in his opinion, justifies an extension of time. If the contractor claims an extension of contract time on the grounds that he is unable to work due to causes beyond his control, written notice of intention to claim an extension of contract time on the above grounds

shall be filed with the Director of Public Works at the time the cause or causes occur. The claim shall be filed in writing within 30 calendar days after the claimed cause for the delay has ceased to exist and shall include a statement of the reasons for the delay, proof to establish the claim, and a statement of the number of days the contractor was delayed.

3. All work shall progress in a continuous and diligent manner. Random scheduling of operations by the contractor will not be tolerated. The Director of Public Works has final authority to determine if the contractor is progressing in a prudent manner and at his discretion can require the contractor to proceed with construction.

4. The Director of Public Works or a designated Engineer will furnish the contractor with all lines, grades and measurements necessary to the proper prosecution and control of the work contracted by the City under these specifications.

   The contractor shall exercise proper care in the preservation of the stakes set for his use or the use of the Engineer, and if he displaces, loses, or removes them during his operations, the cost of the labor and materials required to reset the stakes may be deducted from the final payment to the contractor.

5. Any necessary relocations or adjustments to sanitary sewer facilities shall be made by the contractor. This shall include trunk or district sewer lines and appurtenances as well as house laterals. Any adjustment or removal and replacement which may be required in order to carry out the normal prosecution of the work shall be performed by the contractor in such a manner that the sanitary sewer facility will be left in as good or better condition than existed at the initiation of this project.

   a. Any adjustment or removal and replacement called for under this provision will not be recognized as a basis of claim by the contractor for additional compensation unless such items are set forth in the schedule of the proposal as bid items. In general, the moving of other utilities, where in conflict with the improvement, will be done by the respective controlling utility at its own expense and at no cost to the contractor. The work by these utilities may be completed before the contractor progresses to the points affected. Under some circumstances, however, the work of the utilities may have to be performed during the contractor's construction. It shall be the responsibility of the contractor to coordinate his work with that of the Utility so as to cause the least possible delay in the work. No utility, public or private, shall be moved to accommodate the contractor's equipment or his method of operation when such utility does not interfere with the improvement under construction or to be constructed unless all costs of such removal and replacement, when permitted, will be paid for by the contractor.

   b. Where utilities are affected by other City Ordinances, codes, or requirements, such ordinances, codes, or requirements shall be recognized and followed.

6. The Director of Public Works or a designated Engineer has authority to suspend work wholly or in part for such period or periods as he may deem necessary due to the failure of the contractor to correct conditions unsafe for the workmen or general public; when weather or other conditions are such that in the judgment of the Engineer the work may be done at a later time with advantage to the City; for failure to carry out orders; for conditions considered unsuitable for the prosecutions of the work; for failure on the part of the contractor to comply with any of the provisions of the contract; or for any other condition or reason deemed to be in the public interest. Should it become necessary to stop work for an indefinite period, the contractor shall store all materials in a manner that will protect them from damage and will not unnecessarily obstruct traffic; shall take every precaution to prevent damage to or deterioration of the work performed; and shall provide suitable drainage of the roadway by opening ditches, shoulder drains, etc.; and by erecting temporary structures where necessary. The contractor may suspend work for reasonable cause upon the written approval of the Director of Public Works. Liquidated damages shall not accrue during the period in which work is suspended by approval of the Director of Public Works unless such suspension is due to the failure of the contractor to comply with the provisions of the contract. If work has been discontinued, the contractor shall notify the Director of Public Works in writing at least 48 hours before resuming operations.

7. The City reserves the right to terminate the contract by giving at least five (5) days' prior written notice to the contractor, without prejudice to any other rights or remedies of the City should the contractor be adjudged a bankrupt, or if the contractor should make a general assignment for the benefit of its creditors, or if a receiver should be appointed for contractor or for any of its property, or if contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workmen or proper material, or if contractor should refuse or fail to make prompt payment to any person supplying labor or materials for the work under the contract, or persistently disregard instructions of the City or fail to observe or perform any provisions of the contract.

8. In the event the contract is terminated pursuant to Paragraph G-7 (Termination), then the City may take over the work and prosecute the same to completion, by contract or otherwise, and contractor and its sureties shall be liable to the City for any costs over the amount of the contract thereby occasioned by the City. In any such case the City may take possession of and utilize in completing the work, such materials, appliances and structures as may be on the worksite and are necessary for completion of the work. The foregoing provisions are in addition to, and not in limitation of, the rights of the City under any other provisions of the contract, city ordinances, and state and federal laws.

9. It is intended that cleanup and temporary seeding of the disturbed areas shall follow closely after and at the same rate as construction. At a minimum, the contractor shall commence cleanup operations within fifteen (15) calendar days after beginning work on the project, unless otherwise directed by the Director of Public Works. If, in the opinion of the Director of Public Works, a hazardous, unsafe, or nuisance condition exists, the Engineer may order cleanup operations to commence immediately.

At the completion of the work, the contractor shall clean any street right-of-way or other area occupied by him in connection with the work of all rubbish, excess materials, temporary structures, barricades, equipment, or other such object. All parts of the work shall be left in a neat and presentable condition, ready for use. Payment for cleanup and temporary seeding up will be considered as included in the price bid for the various other items of work and no additional payment will be made.

10. Time is an essential element of the contract, and it is therefore important that the work be pressed vigorously to completion. Should the contractor or, in case of default the surety, fail to complete the work within the time specified in the contract, or within such extra time as may be allowed in the manner set out in the preceding sections, a deduction of an amount as set out in the proposal form will be made for each and every calendar day that such contract remains uncompleted after the time allowed for the completion, except as modified in Section G-6 (Temporary Suspension of Work) of this chapter. The said amount set out in the proposal is hereby agreed upon, not as a penalty, but as liquidated damages for loss to the City and the public, after the expiration of the time stipulated in the contract, and will be deducted from any money due the contractor under the contract, and the contractor and his surety shall be liable for any and all liquidated damages. Permitting the contractor to continue and finish the work or any part of it after the expiration of the specified time, or after the extension of the time, shall in no way operate as a waiver on the part of the City or any of its rights under the contract.

11. At the pre-construction meeting the contractor shall submit to the Director of Public Works a progress schedule showing the proposed sequence of work, and how the contractor proposes to complete all of the pay items within the time specified. No work may begin without this schedule being approved.

H. Measurement, Payment, and Guarantee

1. Contractor will be paid for quantities actually constructed or performed as determined by field measurement (except as may be herein after provided) at the unit price bid for the items listed in the schedule of the proposal or for such extra work as may be authorized and approved by the Director of Public Works. The cost of incidental work not listed in the schedule of the proposal but necessary for the completion of the project will be considered as included in the price bid for the various items of work.

2. Extra work performed in accordance with the requirements and provisions of Section C-8 of this chapter will be paid for at the unit prices, lump sum or as per the force account procedure stipulated in the order authorizing the work.

3. Final payment will not be made to the contractor until the project is inspected and accepted by the Director of Public Works and all requirements of the contract documents are found to have been carried out. Final payment may not be made until the consent of surety is received for final payment.

4. Project acceptance by the City or monies due to the contractor will not be delivered to the contractor without presentation to the Department of Public Works the Certificate of Compliance and Affidavit form shown herein after.

5. The contractor shall be responsible for the condition of all material and all work performed as part of this contract and such material and labor shall be guaranteed by the contractor and his surety against defective workmanship and/or material found to be defective in manufacture or which has been damaged in handling or placement after delivery for a period of 12 months after acceptance by the City. Contractor shall repair, replace, or otherwise make good at his own expense any such defect or failure which may become evident within the guarantee period, excepting as may be due to normal use or wear.

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The bidder may submit any additional information he so desires.

1. Name of bidder _____
2. Permanent main office address _____
3. When organized _____
4. If a corporation, where incorporated _____
5. How many years have you been engaged in construction under your present firm name or trade name? _____
6. General character of work performed by you _____
7. List the more important contracts recently completed by you, stating approximate gross cost for each, and the month and year completed. _____
   _____
8. Contracts on hand: (Schedule these, showing gross amount of each contract and the respective anticipated dates of completion.) _____
   _____
9. Have you ever failed to complete any work awarded to you? If so, where and why?
   _____
   _____
10. Have you ever been put on liquidated damages on any contract awarded to you? If so, where and why? _____
11. Have you ever defaulted on a contract? If so, where and why? _____
    _____
12. Has your firm ever engaged in litigation for the settlement of claims or disputes arising out of a construction contract? If so, give particulars. _____
    _____
13. List your major equipment available for Public Works Projects. _____
    _____
14. To what extent would you expect to employ subcontractors? _____
    _____
15. Experience in construction work similar to importance to Public Works Projects.
    _____
    _____
16. Background and experience for the principal members of your organization, including the officers. _____
    _____
17. Give bank reference. _____
18. Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by the Department of Public Works of the City of Farmington, Missouri? _____
19. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Department of Public Works of the City of Farmington, Missouri, in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated at _____ this _____ day of _____, 20____.
Name of Bidder

_____
By _____
Title _____

State of _____)
)
County of _____)

_____, being duly sworn, deposes and says that he is
_____ of
(TITLE)
_____
and that the answers to the foregoing questions and all statements therein contained are true and correct. Subscribed and sworn before me this _____ day of _____, 20_____.

_____
My commission expires: _____ Notary Public

CERTIFICATE OF COMPLIANCE
AND AFFIDAVIT

STATE OF MISSOURI)
) SS.
COUNTY OF _____)

Re:ContractNo._____
WageDeterminationNo._____
Between:_____
_____

(a) _____ on his oath being duly sworn states that all subcontractors have been paid and that the contractor and all subcontractors have discharged fully all indebtedness incurred by them, or any one of them or for work and labor done, or for materials or equipment furnished or used in connection with the performance and the completion of said above stated construction project and that all claims whether to persons or property arising out of or related to any manner whatsoever to the said construction project have been paid or settled and that all contractors and subcontractors employed or who did work on said construction project have complied with all provisions and requirements of Sections 290.210 to .340 RSMo 1959 as amended 1969 and that all workmen performing work under this contract were paid not less than the general prevailing straight time hourly wage rates or the general prevailing hourly rates for legal holidays and overtime work as such rates were determined and certified in the Special Wage Determination made by the Industrial Commission of Missouri and attached to the said contract herein.

(b) The contractor has complied with all terms and conditions of the contract.

(c) Attached herewith is certification by the Registered Land Surveyor stating that all lot pins disturbed by the construction have been reset in accordance with Chapter II, Section C, Paragraph 6, of the General Conditions and Technical Specifications.

_____

Subscribed and sworn to before me this _____ day of _____, 20_____.

_____
Notary Public

My commission expires: _____

Section 427.020. Earthwork

A. Clearing and Grubbing

1. This work shall consist of clearing, grubbing, removing, and disposing of vegetation within the limits of right-of-way and easement areas, except such vegetation as is designated to remain or to be selectively treated. Demolition of buildings and structures including foundations and slabs shall be as specified in the Special Provisions or on the plans.

2. The plans for the project will establish right-of-way and construction lines and will designate all trees, shrubs, and plants that are to remain. The contractor shall preserve without damage any trees and shrubs designated to remain. All trees, stumps, brush, and hedge not designated to remain shall be cleared and grubbed as required and shall be disposed of in an acceptable manner.

   Stumps and roots in fill and cut areas shall be grubbed to a depth of not less than 12 inches below the existing earth grade. Stump holes shall be back-filled with suitable material and compacted to the approximate density of the adjacent area. Grubbing of borrow areas, channel changes, and inlet and outlet easements will be required only to the extent necessitated by the proposed construction.

   Burning of products from clearing and grubbing operations will not be permitted without obtaining permission to burn from the City Fire Department. The burial of stumps and debris will not be permitted on the right-of-way. Products of clearing and grubbing shall be removed from the right-of-way and disposed of out of sight from the roadway provided an acceptable written agreement with the property owner on whose property the products are placed is submitted by the contractor.

   Within the construction limits of the project, the contractor shall trim any tree which does not provide nine (9) feet vertical clearance above any sidewalk and fourteen (14) feet vertical clearance above any street. Tree trimming shall be done before final payment and the trees shall be shaped at the direction of the Director of Public Works. This tree trimming shall be considered incidental to the contract and no additional compensation shall be allowed.

3. The accepted quantities of clearing and grubbing will be paid for at the lump sum price as stated in the contract. Payment for this item will be made at the completion of the clearing and grubbing operation. When no pay item for clearing or grubbing is included in the contract, clearing and grubbing, including scalping, will be considered incidental to the work and no direct payment will be made.

B. Temporary Erosion and Sediment Control

   The purpose of temporary sediment control is to prevent sediment from leaving the construction site. It will be the contractor's responsibility to prevent sediment from

leaving the construction site and to remove any sediment accumulation and make any repairs necessary after each rainfall event. No direct payment will be made for providing erosion and sediment control.

When construction occurs in low areas where stormwater drainage will be present, erosion along the channel and in the easement areas will be a constant problem during wet periods. The contractor will be responsible to provide whatever methods are necessary to control this erosion and to prevent sediment from leaving the site and entering adjacent or downstream.properties, streams, sinkholes, etc.

This may require construction of silt fences, sediment traps or filters, sediment basins, diversions, temporary ground cover, etc.

Erosion is a natural process; thus, to minimize the effect of erosion, the contractor will be allowed to only excavate and fill in areas where the work is taking place. After 15 calendar days, any exposed soil has to be temporary seeded with Type III mulch. After a rain event, any washouts also have to be repaired and reseeded.

The contractor will be required to:

1. Retain the sediment on site. The contractor shall be responsible to design, provide, construct, and maintain protection from increased and accelerated runoff, sediment from erosion, and other consequences of erosion for all adjacent or downstream properties, storm sewers, creeks, sinkholes, wells, springs, channels, etc., that could receive sediment-laden runoff from the construction site. Straw bale barriers, silt fences, diversions, sediment traps or basins, or other methods may be necessary. The contractor shall be responsible to ensure that stormwater leaving the construction site does not exceed at settleable solids limit of 2.5 ml/l/hr at any time. If the discharge exceeds this limit, then the contractor will have to take immediate corrective action at no additional cost to the project.

2. Minimize the extent and duration of exposure. The contractor shall schedule his work to minimize the amount of area that is exposed at any given time and to complete the work in the area as soon as possible so the ground can be protected with temporary or permanent ground cover. Clearing and grubbing shall be done in sections as needed for construction.

3. Stabilize erosion sensitive areas. The contractor shall provide erosion protection at all stream crossings or other erosion prone areas that are disturbed by this operation as soon as possible after construction is stopped or completed in the area. This erosion protection shall be one of the three methods described below. Decisions concerning type of method, locations, and amounts of erosion control shall be coordinated with the Director of Public Works.

4. Erosion Control Blanket. Erosion control blanket shall be installed in areas deemed necessary and suitable by the engineer and in any locations that the contractor chooses

for erosion control. The area to be covered shall be properly prepared, seeded, and fertilized before the blanket is applied. Installation shall be in accordance with the manufacturer's recommendations. Blanket must be maintained until grass growth is sufficient to control erosion. No direct payment will be made for erosion control blanket. Manufacturer's guidelines will be used for erosion blanket installation.

5. Stone Riprap Facing. Where erosion potential is high and it is deemed necessary by the Director of Public Works, stone riprap facing shall be placed in accordance with standard specifications. No direct payment will be made unless included as a specific bid item. When made, payment will be by the square yard and only in the designated areas.

6. Repair with Excavated Material. In areas where crossings are in rocky material, the channel bed and side slopes may be replaced with the excavated rock, or similar material, when deemed acceptable by the Director of Public Works. No payment will be made for this work. If this method fails to protect the area from erosion, one of the other methods may be required.

7. Protect Stockpiles. Stockpiles of excavated materials, bedding materials, etc., shall be located away from streams protected from rainfall and/or shall drain to a sediment barrier or trap sufficient to handle the flow and provide filtration.

8. Control transport mud to and on public streets. The contractor shall be responsible to control transport of mud to public streets by constructing temporary gravel pads at ingress/egress points, by washing the truck tires, or by other acceptable methods. The contractor will be required to clean the streets of deposited mud as frequently as needed as determined by the Engineer to keep them usable and to control dust.

9. Control dust. The contractor shall provide watering trucks, street cleaning and sweeping, temporary gravel surfaces, or other acceptable methods to keep the dust level in the area at an acceptable level as determined by the Engineer.

10. Protect against chemical pollution. Oil, fuel, or other fluids from construction vehicles or other chemicals used during construction shall not be drained, spilled, or disposed of on the construction site. Empty chemical containers shall be collected and properly disposed of.

11. Protect existing stream banks. Contractor shall use caution to avoid damage to existing stream banks at all possible locations. Stream banks and flow lines that are disturbed shall be restored to as near original shape as possible and shall be protected from erosion.

12. Stabilize all disturbed areas. All disturbed areas shall be protected from erosion no later than 15 days after completion or stoppage of work in the area. This protection may be temporary cover with mulch or blanket if feasible.

13. Inspect and maintain control devices. Contractor shall inspect all erosion and sediment control devices on a weekly basis and after every rainfall event. Any damages shall be immediately repaired. Devices shall also be cleaned and the sediment properly disposed of when needed. If at any time the contractor is found to be in violation of these requirements and does not immediately correct the situation after notification, the City shall have the right to make the necessary corrections and deduct the related costs from the amount to be paid to the contractor or bill the contractor if no payments are being made. ,

14. Basis of payment. Payment for erosion and sediment control will be on a lump sum basis.

C. Grading

1. This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work required for grading the project in coordination with all previous work performed, at the locations shown on the plans, in accordance with the requirements of applicable sections and as provided for in the Special Provisions.

2. Materials and Definitions

   a. Grading as used herein shall be construed to mean the performance of all excavation, embankment, and backfill in connection with the construction of all improvements.

   b. Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.

      1. Unclassified Excavation. Unclassified excavation is defined as the removal of all material encountered regardless of its nature.

      2. Rock. Rock is defined as being sandstone, dolomite, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges 6 inches or more in thickness or similar material in masses more than 1½ cubic yard in volume.

         Should rock be encountered in two or more ledges, each ledge being more than 6 inches thick and with interlying strata of earth, clay, shale, or gravel not more than 12 inches thick in each stratum, the entire volume between the top of the top ledge and bottom of the bottom ledge will be classified as rock.

      3. Earth. All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hard pans) shall be classified as earth.

   c. Embankment is defined as the placing and compacting of suitable material in the construction area to the lines and grades shown on the plans.

d. Material suitable for use as embankment material shall be entirely imperishable and shall be judged acceptable by the Engineer on the site.

1. Earth Materials. Material suitable for earth embankment shall be free of waste material, contain less than forty (40) percent by volume of rock and gravel, and contain no particles having a maximum dimension greater than four (4) inches.

2. Rock Materials. Materials suitable for rock embankment shall be free of waste material and contain sixty (60) percent or more by volume of rock or gravel containing particles with a maximum dimension greater than three (3) inches but not greater than twenty-four (24) inches.

e. Material not suitable for use as embankment material shall include excess excavation material and waste material including mulch, frozen material, organic material, topsoil, rubbish and rock larger than twenty-four (24) inches, maximum dimension.

f. Structures as used herein refers to bridges, culverts, basins, street drainage structures, head walls, retaining walls, footings, foundation walls and similar construction.

3. The contractor shall note location of all existing utilities and facilities as shown on the plans, or as confirmed as a result of a pre-construction conference attended by contractor representatives, public utility organizations, and other interested persons and concerns. The contractor shall be responsible for the protection and preservations of such utilities and facilities.

Grading, excavation and back-filling for roadways, roadway intersections, sidewalks, shoulders, and parkways shall be made to the lines, grades, and cross-sections shown on the plans. During construction, the area shall be maintained in such condition that it will be well drained at all times.

Waste materials including organic material, trees, stumps, rubbish, and debris shall be removed from the site and disposed of as an incidental part of the grading work. Excess excavation material including muck, top soil, and rocks larger than twenty-four (24) inches, maximum dimension, shall be paid for on the basis of the applicable unit bid price for excavation.

It shall be the contractor's responsibility to take the necessary precautions to preserve and protect all existing tile drains, sewers and other subsurface drains affected by his operations. All existing subsurface facilities shall be maintained so their use is not interrupted. The contractor shall repair or replace, at his own expense, any such drainage facility damaged because of negligence on his part.

4. All suitable material removed by excavation shall be used as far as practicable in the formation of embankments as required to complete the work. Any rock encountered within six (6) inches of finished sub-grade shall be removed. The contractor shall sort

all excavated material and stock pile when necessary, so as to provide suitable materials for embankments. The cost involved in sorting stockpiling, or wasting of such material shall be included in the cost for excavation or the cost for embankment, but not both, depending upon which is the basis for bidding as listed in the proposal.

The breaking up and removing of existing concrete or asphalt pavement and miscellaneous structures shall be covered under Demolition, as specified hereinafter. Excavated material in excess of the amount needed to complete the grading shall be considered as waste material and shall be removed from the site. When permitted by the Engineer, a portion of the waste which is suitable for embankment may be disposed of at the site by equitable distribution of the material to specified areas within the project limits. The disposition of all waste material shall be considered as incidental to the performance of grading work.

5. The embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from a contractor furnished site as required to complete the grading work.

   The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material, such as topsoil, peat, mulch, coal seams, disintegrated shale, rubbish, logs or stumps, and unconfined saturated soils, removed to the depths shown before starting the embankment work.

   When embankments two (2) feet or less in depth are to be placed on areas covered by existing pavement, the existing pavement shall be removed and the cleared ground surface shall be compacted to 95 percent of the Standard Proctor Density (ASTM D698). The moisture content shall be not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density. Where embankments greater than two (2) feet in depth are to be placed on areas covered by existing pavement, the existing pavement shall be broken into pieces not larger than twenty-four (24) inches maximum dimension, left in place and the embankment started thereon.

   a. Placing Earth Embankment. Earth shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed nine (9) inches in thickness (loose state) and shall be compacted to not less than the required density before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading will be required to level the surface and to insure uniform compaction. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

   b. Placing Rock Embankment. Successive horizontal layers of rock embankment not exceeding twenty-four (24) inches in depth, shall be made by placing the larger stones uniformly over the embankment area, and between which shall be added small stone fragments, sand, earth or gravel to fill all voids. Rocks, boulders, or old

rubble walls too large to permit placing in twenty-four (24) inch layers shall be broken as necessary, or placed so that proper compaction is obtained around them. Each layer shall be thoroughly compacted before the next layer is placed.

The larger rocks shall be withheld from the top twelve (12) inches or more of the embankment and only crushed stone or earth shall be used in this layer as ordered by the Engineer. The crushed stone shall be well graded, three (3) inches max diameter to form a dense mass when compacted.

c. Embankment Compaction. Density and moisture requirements for embankment and existing surfaces shall be in relation to the maximum density and optimum moisture as determined by ASTM D-698. Embankment material shall be placed with moisture content within the tolerance of the moisture range for each type of material at the specified percent of maximum density as determined by the moisture density curve.

Earth embankment, except the top six (6) inches, and the surface of the existing ground on which embankment is to be placed shall be compacted to at least 90% of the maximum density as determined above. The top six (6) inches of the embankment shall be compacted to at least 95% of the maximum density.

All the work involved in either adding moisture to, or removing moisture from embankment materials to within the moisture limits shall be considered incidental to the completion of the grading operation.

During the progress of the work, the in-place density of the embankment will be determined by ASTM D – 1556 or D - 2167. Unless otherwise stated in the Special Provisions, testing for compaction shall be at the expense of the City.

If abandoned underground tanks of any kind are encountered, then the tanks and their contents shall be removed and disposed of and the area immediately backfilled with select material. This disposal shall meet with all Federal, State and local laws and regulations. If an unidentifiable material is found in the tank, then call the Missouri Department of Natural Resources for identification before removal.

6. Where materials are encountered below grade which are deemed unsatisfactory by the Engineer for use in the work, either cut compaction or under grading shall be performed, as determined by the Engineer.

Cut compaction shall include the temporary removal of material 12 inches below the bottom of the lowest base course for the full width of the road bed. The exposed material, to a depth of 6 inches, shall be manipulated and compacted to not less than the required density. The previously excavated material above this compacted plane shall then be replaced in layers not exceeding 8 inches loose thickness, after being wetted or dried as necessary, and compacted to the specified density. The entire volume so

handled and compacted including the 6 inch layer compacted in place, will be considered as Cut compaction for payment as per the unit price bid in the contract.

Undergrading shall include the removal of earth materials below grade to the depths and limits designated by the Engineer. The excavated area shall then be back-filled to grade with crushed stone sized from a minimum of 2 inches up to 6 inches as designated by the Engineer. The excavation and crushed stone fill will be considered as Undergrading and paid for at the unit price bid in the contract.

On private development projects, all improvements that are to be dedicated to the City will be required to meet the above construction specifications.

7. Slides in the side slopes, after construction to the lines and grades shown on the plans shall be repaired by the contractor at his own expense before final acceptance by the City.

8. The entire project area shall be left in a finished and neat appearing condition.

   The final graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish, and shall be finished to the lines, grades, and cross-section shown on the plans, including shoulder, berm and sidewalk spaces.

   The contractor shall repair any damaged surface, and shall not use any finishing equipment that will leave a marred surface.

9. Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The contractor shall remove from the site of the work all equipment, tools, and discarded materials, and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered as incidental to the completion of the grading work. If in the opinion of the Engineer a hazardous, unsafe or nuisance condition exists, the Engineer shall order cleanup operations to commence immediately.

10. Unless otherwise set out in the Special Provisions, payment for grading work will be based on quantities computed from the plans for units itemized in the Proposal. No direct payment for rock removal will be made unless specified in the contract special provisions.

D. Subgrade Preparation

1. Scope of Work. This work shall consist of preparing the sub-grade upon which a base course is to be constructed or a surfacing placed.

2. Preparing the Subgrade for Pavements. The sub-grade for pavements (except sidewalk and driveway pavement) shall consist of compacted earth overlaid with a minimum of

four (4) inches of compacted Type I aggregate base (see Chapter VII Section B), and shall extend to 1' - 0" outside back of curb.

Shape the earth subgrade to longitudinal and cross-section grade. Scarify to a depth of at least 8" in both cut and fill sections, have the moisture content adjusted to a range of ±2% from optimum moisture content for stability. Contractor to verify that compaction is a minimum of 95% Standard Proctor Density (ASTMD-698). Shaping, scarifying, and compaction are to be done on singularly large areas in cone continuous operation. The contractor is to use compaction equipment of a type and design manufactured to have all the capabilities required to fully meet all the needs of this project.

The aggregate sub-grade material shall be four (4) inches of compacted Type I aggregate base. The aggregate base shall be spread in one lift at a depth greater than the four (4) inches required to allow for shaping and compacting. Water shall be applied as necessary to obtain a density of not less than ninety five (95) percent of standard maximum density as determined by ASTMD - 698.

Shaping and compacting shall be performed until a true, even, and uniform surface of proper grade, cross section and density is obtained.

3. Compacting the Disturbed Sub-Grade for Sidewalks. The sub-grade for sidewalk pavements shall be tamped or rolled until compacted to 95% proctor for a depth of at least six (6) inches.

4. Protection and Maintenance of Subgrade. The newly finished sub-grade shall be protected or repaired from action of the elements. Any settlement or washing that occurs prior to the acceptance of the work shall be repaired and the specific lines, grades, and cross-section re-established.

   The contractor shall protect all pavements, curbs, curb and gutters and sidewalks from his sub-grade operation with an earth cushion, timber planking, or both where tractors, graders, rollers, or other equipment are required to pass or turn around. All resulting damage shall be repaired. Any damaged work which cannot be repaired to the satisfaction of the Engineer, shall be replaced by the contractor at his own expense.

5. Construction Requirements. The sub-grade shall be substantially uniform in density throughout its entire width. It shall conform to the lines, grades, and typical cross sections shown on the plans, or as established by the Engineer. Where hauling results in ruts or other objectionable irregularities, the contractor shall reshape and re-roll the sub-grade before the base or surfacing is placed. If any existing roadway comprises any part of the roadbed, the contractor shall loosen the compacted portions to a depth of at least six (6) inches and shall reshape the roadbed.

   The sub-grade shall be brought to the specified lines, grades, and cross-section by repeatedly adding or removing material and compacting to the specified density with a suitable roller.

The sub-grade shall be checked after rolling, and if not at the proper elevation at all points, sufficient material shall be removed or added and compacted to bring all portions of the sub-grade to the required elevation and density.

Prior to laying base or setting paving forms on projects, the sub-grade shall conform to the density requirements for compaction. Soft spots and unsuitable material shall be removed and back-filled with approved stable material.

6. Subgrade soil inspection shall consist of following two (2) methods:

   a. Moisture and density control: When compaction of embankment is a requirement of the contract and testing has been specified as a pay item AASHTO T99 testing procedures shall be used to determine the field density of the constructed embankment for the following conditions with all results being reported to the City:

      1. Embankment in place (cut section). Subgrade is to be scarified to a depth of six (6) inches below grade for a distance of two (2) feet beyond the proposed edge of pavement and compacted to a minimum of ninety-five percent (95%) maximum density. The rate of density testing shall be a minimum of one (1) test per five hundred (500) linear feet of roadway.

      2. Borrow material (fill section). When embankment construction requires imported material, that material shall be placed in lose lifts with a maximum thickness of eight (8) inches and compacted to a minimum of ninety percent (90%) maximum density to within eighteen (18) inches of top layer of subgrade which shall require a minimum ninety-five percent (95%) maximum density. Testing frequency shall be one (1) test per five hundred (500) linear feet of roadway.

   b. Visual Inspection. When compaction of embankment is a requirement of the contract but has not been specified as a pay item the contractor shall distribute all equipment movements over the entire embankment area. Prior to placement of aggregate sub-base the City shall be contacted to visually observe proof-rolling operations consisting, at a minimum, of a single-axle dump truck with a minimum load of ten (10) cubic yards of crushed rock material. If any area(s) are determined by the City to be substandard the City will be responsible for delineating the extent of the substandard areas and the contractor shall remove and replace all designated areas with suitable fill material as determined by the City. Compactive efforts shall continue, if necessary, until the City approves all areas of embankment.

   c. Prior to construction of street or alley pavements, adequate surface and subsurface drainage facilities, if required, are to be installed by the developer. All drainage facilities shall be sized and specified by a professional engineer, registered in the State of Missouri.

7. No direct payment will be made for sub-grade preparation.

E. Filling Existing Manholes, Catch Basins, Inlets and Miscellaneous Structures

1. This work shall consist of all work necessary to abandon existing manholes, catch basins and inlets and miscellaneous structures in accordance with the specifications, when indicated on the plans or directed by the Engineer.

2. Method of Construction

   a. The tops of all existing manholes, catch basins, and inlets to be abandoned shall be lowered to at least eighteen (18) inches below the sub-grade of the proposed improvement, the outlet connection shall be securely sealed with concrete or brick masonry, and the structure filled with granular material and thoroughly tamped.

   b. Frames and grates of manholes, catch basins, and inlets to be abandoned shall be carefully removed and delivered to the city at a designated location.

3. Basis of Payment. This work shall be paid on a unit price basis for each item complete including all labor, construction, equipment, and materials.

F. Demolition

1. This work shall consist of the removal and satisfactory disposal of existing structures, except such structures, or portions thereof, as may be required or permitted to be left in place by the plans and specifications or at the direction of the Engineer.

2. Construction Methods.

   a. Unless otherwise specified, all portions of existing structures within the right-of-way above the ground surface as it existed before the work was started, that interfere in any way with the new construction shall be removed.

   When explosives are used in demolition, the contractor shall use the utmost care to prevent injury to persons and property, and shall meet all Federal, State, County and City requirements for handling and storing explosives.

   Blasting or other operations which might endanger the new work shall be completed prior to the construction of any part of the new structure. (Refer to Chapter II – General Conditions; Section F-Legal Relations & Responsibility to the Public; Item No. 9 – Use of Explosives)

   When required by the plans or special provisions, all materials from existing structures which the Engineer deems fit for use elsewhere shall be moved without damage, in Sections which may be readily transported and shall be disposed of as directed by the Engineer.

b. Existing structures shall be removed for their entire width and depth unless otherwise noted on the plans. Existing drainage structures shall be removed, or the ends completely and substantially sealed with masonry as required by the Engineer.

c. All concrete and masonry, drainage pipes, reinforcement steel, structural steel, castings, or timbers not salvable shall be disposed of by the contractor at his own expense, and to the satisfaction of the Engineer at a location provided by the contractor outside the limits of the right-of-way. Any of the above materials deposited adjacent to the right-of-way shall be deposited with the written approval of the property owner. The contractor shall obtain and file with the Engineer the written approval of the property owner.

d. All materials removed from old structures which are required to be salvaged under the contract and which the Engineer deems fit to re-use shall be stored without damage in a neat and presentable manner at locations designated by the Engineer, adjacent to the site of the work.

3. If the contract contains a separate item and unit price for REMOVAL OF EXISTING STRUCTURES, such price shall be payment in full for the satisfactory removal and disposal of the existing structures so designated on the plans or in the proposal as a unit under this item. The cost of removal and disposal of all other existing structures shall be considered as included in the contract unit price for the major item of work in the contract.

G. Removal Of Existing Pavement, Curb, Combination Curb and Gutter, Driveway Pavement, And Sidewalk

1. This work shall consist of the removal and satisfactory disposal of existing Portland cement concrete pavement and/or base course, curb, curb and gutter, gutter, or sidewalk, floors and similar concrete objects.

2. Construction Methods.

a. Unless otherwise specified, all portions of existing pavement, curb, combination curb and gutter, or sidewalk, floors and similar objects within the right-of-way above the ground surface as it existed before the work was started, that interfere in any way with the new construction shall be removed.

When explosives are used in demolition, the contractor shall use the utmost care to prevent injury to persons and property, and shall meet all Federal, State, County and City requirements for handling and storing explosives.

Blasting or other operations which might endanger the new work shall be completed prior to the construction of any part of the new structure. (Refer to Chapter II – General Conditions; Section F-Legal Relations & Responsibility to the Public; Item No. 9 – Use of Explosives)

b. Existing structures shall be removed for their entire width and depth unless otherwise noted on the plans.

c. All concrete, asphalt, drainage pipes, reinforcement steel, structural steel, etc., shall be disposed of by the contractor at his own expense, and to the satisfaction of the Engineer at a location provided by the contractor outside the limits of the right-of-way. Any of the above materials deposited adjacent to the right-of-way shall be deposited with the written approval of the property owner. The contractor shall obtain and file with the Engineer the written approval of the property owner.

d. Where portions of these objects are to be left in place, they shall be removed to an existing joint or to a new joint sawed to a minimum depth of one (1) inch with a true line and vertical face. Sufficient portions of such objects shall be removed to provide for proper grade and connection to the new work.

3. Basis of Payment. Removal of existing pavement, curb, combination curb and gutter, driveway pavement or sidewalk shall include the removal and satisfactory disposal of the item and payment shall be as stated in the contractor proposal.

Section 427.030. Water Utilities

A. Special Conditions

1. These specifications shall apply to water mains extended in the City of Farmington's water service territory.

2. The Contractor shall furnish all required pipe, valves, fittings and other materials, cartage, labor, equipment, tools and plant to satisfactorily complete all the work stipulated herein. Water mains under this contract will be disinfected and prepared for testing by the contractor. The Water Department of the City of Farmington will perform the first sample tests at its expense. If the test fails, the cost of subsequent testing will be borne by the contractor. Refer to Section M paragraph 2 (CLEANING AND DISINFECTION).

B. Intent and Definitions

1. The intent of these specifications is to specify the type and quality of all water main materials, the method and procedure of construction, the inspections and testing methods, and the terms of acceptance by the City of Farmington of any water main work or extension on any main or mains, that are or will be an active part of the water system of the City of Farmington, Missouri.

2. Definitions:

City - City of Farmington, Missouri.

Water Department - Water Department of the City of Farmington, Missouri.

Owner's Engineer - An individual designated by the Owner to fulfill the responsibilities and or duties of an engineer or architect.

Inspector - The engineering or technical inspector or inspectors authorized by the Director of Public Works.

Contractor - The individual or firm to which this contract is awarded.

Owner - Applicant for the approved water main extension (generally the developer).

"Or Equal" - Any part or fitting submitted to the Department of Public Works for evaluation and determined by them to be equal in quality and performance to any currently specified acceptable manufacturer and series.

C. Responsibilities of Contractor and Owner:

1. The owner or city (whichever is applicable) or its engineer shall be responsible for the proper location and grade of the proposed extension. Property pins or accurately located and labeled laths shall be provided at key lot corners, particularly at intersections and curves. The main shall not be located solely from street centerline markers. The installation of the water main extension must be completed prior to installing street pavement on new streets. Possible problems with sanitary sewers, manholes, storm sewers, and drop inlets must be marked and sizes and depths indicated. Failure to provide the above requirements may result in suspension of the work.

2. The contractor shall employ skilled workmen under the supervision of a foreman, experienced in water main construction, to install the main. The inspector may suspend the work for the absence of an experienced foreman until, in his opinion, skilled personnel are provided.

3. The contractor shall be responsible for any failure of the main extension that can be attributed to faulty workmanship or defective materials, and for maintenance of backfilled areas. The contractor will be responsible for a period of one year after final inspection (for City Contract jobs) or for one year after the deed of dedication for the main has been accepted by the City Council (developer extension).

4. The owner shall be responsible for providing necessary easements, actual itemized cost of the water main installation and, after completion of the work, a deed of dedication for transferring ownership of the mains to the City. Failure to provide these documents will result in a refusal of the Water Department to make service connections to the mains concerned.

5. Contractor is responsible for obtaining a permit for work within public street rights-of-way from the City of Farmington Public Works Department, prior to any construction within the street right-of-way. A permit from the Missouri Department of Transportation is required for construction in state rights-of-way.

6. The Contractor shall ensure all construction complies with the City of Farmington's specifications for street and utility construction. Roadway construction and repair to improved streets shall comply with the requirements of the agency having jurisdiction.

7. The contractor shall maintain traffic control devices in compliance with the Manual on Uniform Traffic Control Devices (MUTCD) and any additional requirements of the agency having jurisdiction.

D. Materials

1. Pipe: All pipe shall meet one of the following specifications:

   a. Ductile-Iron Pipe: ANSI/AWWA C151/A21.51-09, Thickness Class 52 or Pressure Class 350, push-on joint, cement-mortar lined, bituminous coated. Acceptable manufacturers are: Griffin, Clow, American, and U.S. Pipe. For restrained joint pipe, acceptable manufacturers are U.S. Pipe TR-Flex™, Griffin Snap-Lok™ and Clow Super-Lock™ or approved equal.

   b. PVC Pipe: Polyvinyl Chloride, meeting ASTM D2241, SDR 21, Class 200, gasket bell-end coupling. Installation requirements shall be the same as ductile iron pipe. Acceptable manufacturers are: Extrusion Tech, Inc., PW Eagle, Inc., JM, Certainteed, Diamond, Ipex Blue Brute, Freedom Plastics, and Napco. Centennial Plastics and Silver-Line Plastics (2. flexible polyethylene, ASTM D2737/SDR 9 CTS, 2.125. OD/1.653.ID, 200 PSI.)

   c. C-900 PVC (4-inch and larger): Water mains shall conform to AWWA C900 DR 14. Pipe must bear the seal of approval of the National Sanitation Foundation. Net laying lengths must be 20 feet. Joints shall be integral bell position joints with single rubber gasket, making pressure tight seal, as listed in the C900 Standard.

2. Ductile Iron Fittings: To meet ANSI/AWWA C110/A21.10-08 or ANSI/AWWA C153/A21.53-06, mechanical joint, bituminous coated; 12-inch to 24-inch fittings to be rated at 350 psi; 30-inch and larger fittings to be rated at 250 psi. "T" bolts shall be NSS Cor-Ten or NSS Cor-Blue or equal. Acceptable manufacturers are: Clow, Trinity, Union, Tyler, Griffin, Star, U.S. Pipe and Sigma.

3. PVC Fittings 6"-8": To meet ASTM D2241, pressure class 200. Acceptable manufacturers are Ipex Blue Brute and Certainteed (for couplings only). Branch, bend, transition or cap type fittings to be used with rigid plastic shall be flanged or mechanical joint cast or ductile iron. The fitting item shall be furnished with and include all bolts,

glands, transition gaskets, etc. as required to fully make up the fitting connection joints. Mechanical joints with retainer glands shall be used in lieu of concrete thrust blocking.

4. Valves

   a. Gate Valves: NRS resilient wedge for buried service, conforming at a minimum to AWWA C509-09 or AWWA C515-09 for 16" and larger; 2" square operating nut; open left; MJ X MJ; wedge rubber shall be molded and bonded in place to the wedge and shall not be mechanically attached with screws, rivets, or similar fasteners; wedge shall seat so the seating is equally effective regardless of direction of pressure unbalanced across the wedge; waterway shall be full diameter, smooth and shall have no depressions or cavities in the seat area where foreign material can lodge and hinder closure or sealing, the valve body and bonnet shall be fusion bonded epoxy coated, inside and out, and the valve shall be provided with stainless steel bonnet and packing bolts, "T" bolts for the MJ fittings shall be NSS Cor-ten, Cor-Blue or equal. Acceptable manufacturer and series for 16" and larger gate valves are Clow RW and Mueller A-2361. For all other sizes less than 16", acceptable manufacturers are: Clow ULFM - AWWA R/W, and Mueller Resilient Wedge Gate Valve #2360 or others which may be considered equal with prior approval.

   b. Tapping Valves: Same as Gate Valves above except that it shall be equipped with a raised lip constructed in accordance with MSS-SP60 to provide for centering of the valve on the tapping saddle. Acceptable manufacturers and series are: acceptable manufacturers are: Clow ULFM - AWWA R/W, and Mueller Resilient Wedge Gate Valve #A2360 or others which may be considered equal with prior approval.

   c. Butterfly Valves: Rubber-seated for buried service, conforming as a minimum to AWWA C504-06; 2" square operating nut; open left; MJ X MJ; butterfly shall seat so the seating is equally effective regardless of direction of pressure unbalanced across it, the resilient seat shall be attached to the body of the valve and not the butterfly, the valve interior shall be epoxy coated and the exterior shall be epoxy or bituminous coated. Acceptable manufacturers are: Val-Matic or equal.

   d. Gland Packs: All valves and mechanical joint manufacturers are to supply their domestic accessory gland pack with their fittings and/or valves. The manufacturers brand shall be clearly cast into the gland and also clearly printed onto any box or package in which the gland pack is shipped. If the gland pack and box are not so marked, a certification from the valve and/or fitting manufacturer will accompany each shipment certifying that the specific gland pack shipped is approved by the manufacturer for use with the valve and/or fitting. Eagle gland packs from Russell Pipe may be accepted for use with D.I. fittings and valves in lieu of manufactured gland packs or certified substitutes. All glands must be ductile iron.

   e. Tapping Sleeves: Manufactured from all stainless steel group 18-8, material 304 including sleeve, outlet neck, outlet flange, and all bolts and nuts; top of shell shall be a minimum of 11 Ga. plate and bottom of shell shall be a minimum of 14 Ga. plate;

seal to be full circumferential gridded and approved for potable water; flanged outlets shall be indexed per MSSSP 60 to accept tapping valves with an ANSI 150 lb. drilling IAW AWWA C207; neck to accept full sized cutter. Acceptable manufacturers and series are: Ford FTSS, JCM #432Smith Blair #665 and 665 MJ, Power Seal Model #3490 AS and Model #3490 MJ, and Mueller H304.

f. Valve Boxes: All valve boxes shall be 6" PVC water pipe, 6" Ductile Iron under all paved areas. During construction the valve boxes shall extend from 2 to 3 feet above grade to remain visible to other construction trades and traffic. Once final grade has been established, the valve boxes shall be cut to grade. It shall be the contractor's responsibility to ensure the valve boxes are cut to grade. All valve boxes shall be vertical, clear of mud and debris and capped with a Clay & Bailey #2194 valve box cover. All valve boxes shall be installed upon the valve with the use of a Valve Box Adaptor II 6" PVC as manufactured by Adaptor Inc. or an approved equal. Acceptable manufacturers shall be the same as those listed for PVC pipe, 4"-12" under the Materials Section of this set of specs.

5. Fire Hydrants: Mueller Super Centurion 250, A423. Fire and flush hydrants permitted for use on all water system mains shall be supplied by Mueller or approved equal. Each hydrant shall be of the traffic model type and manufactured to withstand a working pressure of 150 psi. in full compliance with the AWWA standard specifications C-502 of the latest revision. Hydrants shall be three way having two (2) hose nozzle connections and one (1) pumper nozzle connection. All hydrants shall have 5 ¼-inch valve openings for mechanical joint connection to minimum six (6) inch water main unless otherwise noted. Hydrants shall be color coded to indicate available flow as directed by the City.

   a. Auxiliary Valves: Fire hydrants are to be installed with auxiliary valves. Valves to be used for this purpose shall meet the requirements as stated in these specifications. If the auxiliary valve is not directly connected to the main tee branch and hydrant, steel rods shall be used to secure the connection. Each valve shall be furnished with a valve box and all joint accessories as required.

   b. Blow-Off Hydrants: Blow-off hydrants shall be two (2) inch post type flushing hydrants. The hydrant shall be Eclipse No. 2 as manufactured by Kupferle Foundry, or Model A-411 as manufactured by the Mueller Company, with a two (2) inch mechanical joint inlet and a single, two and one half (2 ½) inch threaded outlet nozzle. Hydrant shall incorporate a dry barrel design to prevent freezing, and shall be "red" in color.

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

6. Tracer Wire: Water main locator wire shall be installed with all water main, fittings, and valve installation. The material to be installed for this purpose shall consist of standard electric service wire, a single No. 12 U.L. approved copper wire of the solid type with

insulation for 600 volts. Insulated wire for this service shall be provided in standard rolls of not less than five hundred (500) foot lengths.

a. Splices: Where required, due to roll termination or necessary contact location, the locator wire shall be spliced using standard plastic or rubber wire connectors. The connector opening shall be sealed using a liquid plastic sealant to prevent moisture entrance. After splicing and sealing the connection, the splice location shall be loosely knotted to prevent stress on the connector joint.

b. Wire Contact: In order to make use of the wire for water main location purposes, a splice point shall be placed adjacent to a valve box location. The wire shall be brought to the ground surface at these locations so a power source can be connected. The wire shall run outside up alongside the valve box, then through a hole into the valve box just below ground level. The splice connector shall be left exposed at the top of the valve box at the wire contact locations. Wire contact points shall be provided at not more than 1,000-foot intervals.

7. Concrete: All concrete work shall meet A.S.T.M. Standards C150 (type 1), C260, and C33. Concrete shall be Class A, 6 bag mix, 5-inch slump, 3,000 psi minimum compressive strength in 28 days.

8. Anchors, Inserts, Reinforcements: All thread rod shall be 3/4" stainless steel, group 18-8, material 304, minimum yield of 30 ksi, minimum tensile 70 ksi. Nuts shall be hex head, 3/4" stainless steel, group 18-8, material 304. "DUC-LUGS" shall not be used on 12" or larger fittings and valves. Cor-Ten anchor eye-bolts may be used in lieu of "DUC LUGS" on 12" and larger valves and fittings, anchor eyes or rods shall tie directly into bolt holes on fittings and valves. Stainless steel washers shall be utilized with all tie rods and nuts. Stainless steel all-thread rod shall only be joined with stainless steel extension nuts. DUC-LUGS shall not be used to extend stainless steel all-thread rod.

9. Casing Pipe:

a. Steel: Steel casing pipe wall thickness shall conform to the following schedule:

CASING DIAMETER	MINIMUM WALL THICKNESS
6, 8, 10, 12"	.188"
14, 16, 18"	.250"
20, 22, 24, 26, 28, 30"	.3125"
32 through 48"	.4375"

All pipe shall conform to all applicable requirements of AWWA C200-17 and AWWA M11, and if fabricated shall be constructed of A36 steel with a minimum yield point of 36 ksi; or if manufactured shall conform to Grade B with a minimum yield point of 35 ksi. It may be shipped in random lengths between 18 and 22 feet and shall have one end cut square and one end beveled. All casing pipe is to be joined with 360 degree welds. It shall be mill primed and coated with bituminous based

coating before installation. Where coating is damaged during installation, it shall be repaired and replaced by thorough brushing or scraping to sound material and applying two coats of the coating material.

b. Concrete Pipe: Concrete pipe utilized for encasements shall be steel reinforced concrete pipe and shall conform to the material and installation specifications of the Missouri Department of Transportation.

10. Casing Spacers: The casing spacers shall have a bolt on shell made in two sections. All metal components shall be Type 304 (18-8) Stainless Steel. It shall have an elastomeric liner to isolate the shell from the carrier pipe. It shall have runners attached to the shell and be designed to provide a minimum of .75 inches clearance between the carrier pipe's greatest outside diameter and the casing pipe's inside diameter. The chock runners shall be beveled with high abrasion resistance and a low friction coefficient. Acceptable manufacturers and models are: PSI S8G-2 and PSI S12G-2, Power Seal #4810, Cascade CCS series, Advance Products & Systems Model SSI and BWM SS-8. Alternatively, Raci spacers by PWM may be used.

11. Pipe Restraints: All pipe restraints shall be ductile iron for use on ductile iron MJ fittings with ductile iron or SDR 21, Class 200 PVC pipe. All joint restraints shall have a minimum of 150 PSI pressure rating. Restraint systems that use set screws to hold the gland to the pipe are unacceptable. All T-bolts and studs shall be high strength, low alloy steel (Cor-Ten or equal).

    Acceptable manufacturers and series are:

    For DIP: EBAA Iron MEGALUG series for D.I. pipe only and Uni-Flange series 1400 for D.I. pipe. For PVC: EBAA Iron series 1500 and 2500 bell restraints for C-900 PVC pipe and Uni-Flange series 1500 Circle-Lock. For DIP or PVC: Tyler MJR; Romac Grip Ring; Uni-flange Block Buster 1300 series pipe restraints for DIP or PVC through 12" (except 1360 through 8" only); Smith Blair 981 pipe joint restraints for mechanical joint 4"-12" and Smith Blair 982 pipe joint restraints for bell and spigot joint 4" -12" for C900 PVC and ductile iron pipe; JCM 610 Sur-Grip MJ fitting restrainer and JCM 620 Sur Grip bell joint restrainer for 4" - 12" C900 PVC; and Sigma One-Lok.

12. Pigs: All pigs shall be constructed from open cell polyurethane foam. They shall be of medium density ranging from 5 lb./cu.ft. to 8 lb./cu.ft. and be double dished. All pigs used shall be made for hand launching and specifically for the type and size of pipe being installed. Acceptable manufacturers and series are: Pipeline Pigging Products B-3 DD (Double Dish) 5 to 7 lb. and the KNAAP Polly Pig 5A DD (Double Dish) 5 to 8 lbs.

E. Material Handling

1. PVC pipe and fittings: Shall be handled according to guidelines set out in AWWA M23. The pipe shall not be handled with individual chains or single cables, even if padded. They shall not be dropped to the ground or into the trench and shall not be dropped or

rolled against other objects on the ground. Gaskets shall be protected from excessive exposure to direct sunlight, ozone, oil, and grease. If stored for extended periods the pipe and fittings shall be protected from direct sunlight and shall be laid so as not to become deformed or bent.

2. Ductile Iron Pipe and Accessories: The handling of pipe, fittings, valves, hydrants, and accessories shall conform as a minimum to the standards set out in AWWA C600-05. They shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped or rolled against pipe or fittings already on the ground.

F. Location

1. Alignment and Grade: The water mains shall be laid, and valves, hydrants, and fittings shall be placed in accordance with the plans. Unless otherwise approved by the Engineer, all pipe shall be installed with the following minimum depths: All pipe shall be installed a minimum of 42 inches below finished grade or when installed along streets, 42 inches below the existing street pavement centerline elevation, whichever is greater.

2. Dead Ends: Dead end mains are to be avoided if possible. If it is not possible to avoid a dead end main, the end of the main shall have a fire hydrant. Fire hydrant to be a Mueller Super Centurion 250, A423 (with integral 5" Storz quick-connect). An Eclipse 9700 flushing device (with collar lock and splash pad) will be required on said hydrant.

3. Ells, Tees, Plugs, and Hydrants: All fittings shall have thrust reinforcement, using restrained joints. Concrete thrust blocking shall not be used.

4. Water Mains Near Sewers: The separation between water mains and sewers shall comply with Missouri Department of Natural Resources laws and regulations, including the following criteria:

   a. Horizontal Separation: A water main shall be laid at least 10 feet horizontally from any existing or proposed storm or sanitary sewer line. Where these conditions cannot be met, the Missouri Department of Natural Resources shall be consulted as to the precautions to be taken to protect the public water supply.

   b. Vertical Separation: Where water mains must cross over storm drains, or sanitary sewers, the water main must be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, and a full length of water main pipe must be centered over the sewer to be crossed so both of the joints will be equally distant from the sewer and as remote therefrom as possible. This vertical separation must be maintained for that portion of the water main located within 10 feet horizontally of any storm drain or sanitary sewer that it crosses, said 10 feet to be measured as the shortest distance from the water main to the sewer at that point. Backfill shall be of compacted clay to a minimum of 18" above and below the outside

dimension of the water main and for a horizontal distance of 10 feet from the sewer being crossed. In no case shall the water main and the sewer share the same granular fill bed.

c. Unusual Conditions: Where conditions prevent the minimum vertical separation as set forth above from being maintained or where it is necessary for the water main to pass under a sewer line, the water main shall be constructed of mechanical joint pipe or be encased with a steel casing pipe and backfilled with compacted clay to a minimum of 18" above and below the outside dimension of the water main and for a horizontal distance of 10 feet from the sewer being crossed. In no case shall the water main and the sewer share the same granular fill bed. In making such crossings, a full length of pipe must be centered over or under the sewer to be crossed so that the joints will be equally distant from the sewer and as remote therefrom as possible. Where a water main must cross under a sewer, a vertical separation of at least 18 inches between the bottom of the sewer line and the top of the water main must be maintained with adequate support for the larger size sewer lines to prevent them from settling. In no case shall the water main and the sewer main share the same granular bed. Where these conditions cannot be met, the Missouri Department of Natural Resources shall be consulted as to the precautions to be taken to protect the public water supply.

G. Excavation and Preparation of the Trench

1. Size and Alignment: The trench shall be dug such that the pipe can be laid to the proper grade and alignment as shown on the approved plans. Width of trench shall be so as to have a minimum width of 12 inches greater than the outside diameter of the pipe. Bell relief holes in the bedding shall be provided at each joint to permit proper jointing and ensure the pipe is supported evenly along the entire length of the barrel. Hand excavation shall be employed in trenching when deemed necessary by the Engineer.

2. Tunneling: Tunneling may be permitted or required at the discretion of the Engineer.

3. Bracing and Shoring: It is the responsibility of the contractor to maintain all work in compliance with current Occupational Safety and Health Act (OSHA) standards. Inspectors, engineers or other City personnel shall not enter any trench or excavation not braced or shored in accordance with OSHA Standards.

4. Open Trench:

a. At no time shall there be more than 300 feet of trench opened in advance of the pipe laying operations provided that the trench is backfilled prior to the end of the day's work. This length of open trench may be shortened by order of the Engineer.

b. The contractor shall not allow a cut on any roadway which is open to traffic to remain overnight without capping the cut with a minimum of 3 inches cold mix patch.

5. Rock Excavations:

a. Definition: Rock excavation shall include any excavation which requires the contractor to utilize equipment intended specifically for the removal of rock which encompasses a volume of 1/2 cubic yard or greater amount of rock measured in its original and undisturbed state. Removal of igneous, metamorphic, or sedimentary rock or stone, boulders over two cubic yards in volume in open areas and one cubic yard in volume in trenches; and masonry, concrete, or solid frozen soil that cannot be removed by an excavator with an operating weight of at least 52,600 pounds and flywheel horse power of at least 153 HP, by rippers or other mechanical methods and, therefore, requires drilling and blasting.

b. Trench Width and Depth: Any trench of rock excavation shall be at least 12 inches wider than the outside diameter of the pipe and six inches deeper than the average depth of the trench as required by existing topography or these specifications. In the event of any required undercut, the trench subgrade shall be restored to proper grade by filling and compacting, with an approved material, so as to ensure a uniform bed along the full length of the pipe barrel.

c. Rock Measurement: All rock measurement or estimates to be used for payment purposes shall be made, recorded, and signed in the field in the presence of the Engineer and contractor or their duly authorized representatives. (SEE ALSO Section 427.020 SECTION P)

6. Before starting, the contractor shall be responsible for having located any utilities or services in the area which might be affected. Financial responsibility for damage to any utilities belongs to the contractor.

H. Pipe Laying

1. Laying: All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench by means of ropes or mechanical equipment. Under no conditions may they be dropped or thrown. The inspector may hammer test ductile iron pipe before it is lowered into the trench. Ends of all pipe must be thoroughly cleaned. After placing a length of pipe in the trench, the spigot end shall be centered in the bell; the pipe forced home and brought to the proper grade and alignment. The pipe shall be secured in place with proper backfill material tamped around and over it except at the bells. Bells shall be in the direction of the laying operations. Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination prior to and during installation in accordance with the latest revision of AWWA 651. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Joints of all pipe in the trench shall be

completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the standing water is removed. The interior of each section of pipe shall be inspected immediately prior to installation in the trench to insure it is clean of animals, dirt, debris or other foreign matter. All joint deflections must be within the pipe manufacturer's recommendations, and are hereby included in and made a part of these specifications. PVC pipe may be deflected around curves so long as deflection is in the joint only. No strain shall be placed on the pipe for the purpose of deflection. Manufacturers may vary in the amount of deflection which can be obtained in the pipe joint and their specifications should be consulted.

2. Jointing: All joints must be made as per the manufacturers and AWWA Specifications.

3. Valves: Valves shall be located as designated by Water Department at street, bridge, railroad, waterway crossings, dead ends, and at all fire hydrants. All valves shall be protected by a valve box (SEE ALSO Section 427.020 SECTION E).

4. Tracer Wire: Tracer wire shall be installed on all water mains and appurtenances. The wire shall be installed in such a manner as to be able to properly trace all pipelines and services without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire.

   a. Tracer wire shall be installed in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe to ensure that the wire remains adjacent to the pipe. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all trace wire access points.

   b. Except for approved spliced-in repair or replacement connections, tracer wire shall be continuous and without splices from each trace wire access point. Where intermediate splices are required, the wire connector opening shall be sealed using a PVC joint sealant material to prevent moisture from entering the connection. The wire shall be loosely knotted at each splice location to prevent direct stress on the connection. The wire shall be laid slack in the trench so same will not be subject tensile stress as the trench is being backfilled.

   c. Tracer wire access points shall be accessible at all new water valve boxes, water meter boxes, and fire hydrants. Concentrations of multiple proposed valves near pipe intersections, (i.e. tees or crosses) may require more than one access point assembly in each valve box. Tracer wire access points shall be within public right-of-way or public utility easements.

   d. Tracer wire shall be protected from damage during the execution of the works. No breaks or cuts in the tracer wire or tracer wire insulation shall be permitted. At water service saddles, the tracer wire shall not be allowed to be placed between the saddle and the water main.

e. At all water main end caps, a minimum of 6 feet of tracer wire shall be extended beyond the end of the pipe, coiled and secured to the cap for future connections.

f. For directional boring installations, two #12 tracer wires shall be installed with the pipe and connected to the tracer wire at both ends, or cad welded to the existing iron pipe at both ends. The tracer wires shall be laid flat and securely affixed to the top and side of the pipeline at five foot (5') intervals to ensure its placement during the boring operation.

I. Anchorage

1. Plugs, Caps, Bends: All plugs, caps, tees, end valves, fire hydrant valves, and bends shall be anchored to prevent movement by providing restrained joints.

J. Backfilling

1. Around Pipe: All granular backfill under and above the barrel of the pipe shall be free from debris, organic matter, and stones larger than one inch in greatest dimension, and shall be tamped into place. Aggregate Type shall be fine, clean, durable particles of sand or crushed stone. Crushed stone used for this purpose to an elevation one (1') foot above the pipe end shall consist of materials passing the sieve indicated as follows:

PIPE DIAMETER	GRANULAR MATERIAL
Less and 8"	Type 5
10" and greater	1" Minus

2. Adjacent to Granular Backfill: Backfill over granular material shall be free from debris, organic material, and stones larger than three inches in greatest dimension, and shall be hand placed. If excavated material is not suitable for backfill, the Engineer may require imported material be used; including clean, finely divided soil or crushed stone aggregate (one inch and smaller). If the depth of the trench is over five feet, at least two feet of hand placed fill must be placed over the top of the pipe before a mechanical type fill may be used. On completion of the specified hand fill, the balance of the trench shall be mechanically filled to at least three inches above the proposed finished grade of the surrounding terrain. Backfill shall be free of junk, debris, brush, roots thicker than two inches, and stones or rubble more than six inches in greatest dimension. Top six inches backfill shall be topsoil corresponding to that underlying original sod.

3. Improved Areas: For trenches through any improved area, such as streets, or improved drives, the entire trench shall be backfilled with the same granular material specified for under the pipe. The restoration of these surfaces shall be sufficient to return the area essentially to its previous condition and shall be to the satisfaction of the Engineer. Any backfill in or resurfacing of any portion of an existing street shall be under the requirements of a street-excavation permit. A street-excavation permit may be obtained from the Public Works Office, 12 S Franklin Street.

4. Maintenance of Backfilled Areas: The Owner or City's (whichever is applicable) contractor shall be responsible to maintain backfilled areas to the grade of the surrounding terrain for a period of one year after the main has passed final inspection by the City (for contract jobs) or for one year after the deed of dedication for the main has been accepted by the City Council (for developer extensions). Seeding and mulching or sodding shall be sufficient quality to restore the area essentially to its previous condition and shall be to the satisfaction of the Engineer.

5. Cleaning Up: On completion of contract, contractor shall remove all excess materials or supplies and shall clean up the entire working area and dress the land so as to leave a neat, accessible work area. Any ditches, road, or street shoulders shall be restored to their original alignment and grade. All cleared trees, brush, unearthed rock, excess dirt and trash shall be disposed of. Trees, brush and stumps that are cleared during construction may only be burned with a permit from the Farmington Fire Department. A Missouri Department of Natural Resources burn permit may be required. Waste from items that are allowed to be burned shall be free from embers prior to disposal by the contractor. The contractor shall exercise due care in his construction operations to prevent marring or scarring of trees that are to remain. Care should also be taken so as not to leave soil upon the surface of roads, walks, or other paved surfaces.

K. Connection to Existing Mains

Taps: It will be the contractor's responsibility to acquire utility locates, excavate the water main and install the tapping sleeve and valve on the water main. The valve shall be located a minimum of 36 inches from the nearest bell or fitting. The contractor will also contact the Inspector to let him know that work has started. For a fee established by City Ordinance, the Water Department will pressure test the valve and cut the coupon on the existing water main. Once the Water Department is finished, the contractor may begin to construct the water main out of the tapping valve.

Dead Ends: It will be the contractor's responsibility to acquire utility locates and excavate the water main. The contractor will also contact the Inspector to let him know that work has started. The contractor will be responsible for tying into the existing dead end per the plans. This work shall take place only under direct supervision of the Inspector.

All materials used to tie into existing mains must be disinfected in accordance with the most recent revision of AWWA Standard C651.

L. Operation of Existing Pressurized Valves

All valves under pressure in the mains supplied by the Farmington Water Department shall be operated only by employees of the Water Department except in cases of extreme emergency. All valves installed as a part of new construction shall be left fully closed by the contractor.

M. Testing Water Lines

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

1. Hydrostatic Tests: A two (2) hour test shall be made on each segment of the water lines between end points at a test pressure of 1.5 times the normal maximum operating pressure, not to exceed the design pressure of the pipe (200 psi for SDR 21 Class 200). The test pressure shall be determined by the City and suitable gauges for checking same shall be supplied and connected by the Contractor. A gate valve or pressure relief valves shall be supplied and connected by the Contractor. A gate valve or pressure relief fitting shall be placed at each end of the segment being tested unless otherwise directed. Allowable pressure drop during the two (2) hour test shall be limited to 3% of the test pressure.

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

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

   The Contractor shall furnish the gauge and measuring device for the leakage test, as well as the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary labor to conduct the test. The duration of each leakage test shall be two hours, and during the test, the piping shall be subjected to a hydrostatic pressure of 1.5 times the normal maximum operating pressure of the pipe. Pressure should be maintained at a constant level throughout the testing period; the amount of water added to maintain this pressure shall be measured. If the amount of additional water introduced into the line during the test exceeds the testing allowance in the table below, the section of water main fails the acceptance test. The testing allowance provides for entrapped air, engagement of joint restraints, seating of gaskets, temperature variations and other minor variations; it is not intended to permit actual minor amounts of leakage. Should any tests of pipe installed disclose water loss greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the test is within the specified allowance.

Testing Allowance for PVC Pipe, U.S. gal/hr

Pipe size, in.	Average test pressure in line, psi				
	50	100	150	200	250
	Testing allowance/1,000 ft (50 joints)				
4	0.19	0.27	0.33	0.38	0.43
6	0.29	0.41	0.50	0.57	0.64
8	0.38	0.54	0.66	0.76	0.85
10	0.48	0.68	0.83	0.96	1.07
12	0.57	0.81	0.99	1.15	1.28
14	0.67	0.95	1.16	1.34	1.50
16	0.76	1.08	1.32	1.53	1.71
18	0.86	1.22	1.49	1.72	1.92
20	0.96	1.35	1.66	1.91	2.10
24	1.15	1.62	1.99	2.29	2.56
30	1.43	2.03	2.48	2.87	3.20
36	1.72	2.43	2.98	3.44	3.85
42	2.01	2.84	3.48	4.01	4.49
48	2.29	3.24	3.97	4.59	5.18

3. Tracer Wire Testing: Contractor shall perform a continuity test on all trace wire in the presence of the Engineer. If the trace wire is found to be not continuous, the Contractor shall repair or replace the failed segment of the wire and the run shall be re-tested.

4. Warranty: It shall be the responsibility of the owner or City's (whichever is applicable) contractor to maintain the main and the associated trench and construction area for one year after the acceptance of the main by the City. This responsibility shall not be limited to just faulty materials and workmanship but shall also include damage by other parties such as contractors and utilities. Damage to be within the scope of this responsibility include but is not limited to the cutting of the main by other utilities, theft of valve boxes and lids, over paving of valve boxes, misalignment of valve boxes and flush outs by construction traffic, crushing or misalignment of the main, valves and flushes by construction traffic, settling of the trench, and failure of the seeded and mulched or sodded areas to grow.

N. Cleaning and Disinfecting

1. Pigging: All new water mains 4" and larger, installed with the intention of being dedicated to the City or being installed by contract for the City shall be cleaned and flushed with a polyfoam pig prior to chlorination and sanitation. The contractor shall provide the excavation and backfilling required to establish any temporary pig flush assemblies. The contractor shall be responsible for requesting and coordinating all utility locations prior to excavation. A temporary flush for each pig shall be installed by the contractor and removed after pigging is complete. In its place the contractor shall install

a standard D.E. cap and flush. The pit shall be constructed in such a manner, and the temporary flush removed, so as to prevent the backflow of dirty water into the new main. It shall be the responsibility of the contractor, under the supervision of the Inspector, to flush the pig through. Any excavation, main removal and repair required to extricate a trapped pig shall be the responsibility of the contractor. During the time any excavation is left open, the contractor shall provide all required safety barriers and fencing. When unattended, the area shall be surrounded with poly fencing. Taping off the excavated area is not considered sufficient.

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

   The following tables are provide for reference purposes. This table shows the amount of chlorine needed to maintain 50 ppm chlorine.

Product	Amount of Compound	Quantity of Water to Add to Make 1% Solution
High Test Calcium Hypo-Chlorite (65-70% Chlorine, HTH Parachloron, etc.)	1 lb.	7.5 gal.
Chlorinate Lime (32-35% Chlorine)	2 lbs.	7.5 gal
Liquid Laundry Bleach (Purex or Chlorox)	1 gal.	4.25 gal.

Pipe Size (inch)	Volume of 100 ft. Length (gallon)	Amount Required to Give 50 ppm Chlorine	
		100% Chlorine (lb)	1% Chlorine/Water (gal)
2	16.4	0.0034	1/12
4	65.3	0.0135	1/3
6	146.5	0.0305	¾
8	261.0	0.054	1 1/3
10	408.0	0.085	2
12	588.7	0.123	3

Following the 24 hour period, a chlorine residual level of a minimum of 10 ppm must remain in the segment. If an acceptable residual level is determined, the pressure valve shall again be opened and the segment flushed until all traces of chlorine over and above normal line levels have been eliminated. Flushing: Valves are to be operated only under the direct supervision of Farmington Water Department personnel. Only Farmington Water Department personnel shall operate valves on the existing water system. The super-chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is not detectable. The super chlorinated water shall be discharged to the sanitary sewer system serving the area. Consideration may be given to discharging the super-chlorinated water to the round surface but such discharge must be approved by the Public Works Director prior to any discharge. If the Public Works Director determines that the chlorinated discharge may cause damage to the environment (fish life, plant life, physical installations, or other downstream water uses of any type), then a reducing agent must be applied to the water to be wasted. For the super-chlorinated water to be discharged to the ground surface, the chlorine residual remaining in the water shall be thoroughly neutralized. The following neutralizing agents can be used: sulfur dioxide (SO2), sodium bisulfate (NaHSO4), sodium sulfite (Na2SO3), and sodium thiosulfate (Na2S2O3*5H2O). The table below is for reference in using Sodium Thiosulfate. Recommended application of the neutralizing agent is with a pump sprayer.

Chlorine Residual Neutralizing Table Utilizing Sodium Thiosulfate

Residual Chlorine concentration (mg/L)	Chlorine discharge flow rate (gpm)	Sodium Thiosulfate for neutralizing solution (ounces per gal of water)	Application rate of neutralizing solution to discharge stream (gpm)
25	50	2.8	0.143
50	50	5.6	0.413
25	100	2.8	0.286
50	100	5.6	0.286

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

3. Sampling: Bacteriological test samples will be collected by Farmington Water Department personnel. A sample will be taken after the initial flushing at predetermined sample points. The second sample will be taken 24 hours after the first sample. Both of these samples must pass before the water main will be turned on by Farmington Water Department.

In the event that the main does not pass its first set of bacteriological tests, then the main will be pigged, flushed, chlorinated and sampled again at the contractor's expense. The contractor shall be responsible for digging up the main, reinserting a pig and reinstalling

a pig flush assembly. Once the pig is flushed, the contractor will reinstall the temporary flush assembly for sampling purposes. The main will then be rechlorinated, flushed, resampled and tested. The contractor will be responsible for any costs incurred by its crews or city forces for second or subsequent disinfection and sampling.

O. Pavement Replacement

1. Temporary Replacement. If for any reason a roadway must be opened for traffic, after the water is in place but before the pavement is replaced, then the contractor must provide a one (1)-inch asphalt cap on the trench backfill within 24 hours. This asphalt cap shall be the contractor's responsibility and no additional compensation will be allowed. Backfill and/or asphalt shall be removed as necessary prior to placement of the permanent pavement.

2. Permanent Replacement. All pavement and curbs damaged during construction, in the opinion of the Engineer or Inspector, will be replaced by the City at the Contractor's expense. In order to determine the amount of damage to the pavement and curbs during construction, all existing cracks in the street or curb should be marked/painted in advance of construction. Permanent pavement replacement shall not occur any later than thirty (30) calendar days after backfilling, unless otherwise approved by the Engineer.

3. The existing pavement necessary to be removed for construction shall be sawed in a neat line and removed prior to excavation. The width of this removal will be specified in the special provisions and payment for pavement repair shall not exceed the width specified.

   The paving shall be sawed prior to replacement as to ensure a straight edge and a uniform patch. The subgrade for the new paving shall be further compacted by rolling or tamping. The work shall be coordinated with the Director of Public Works.

P. Inspection

1. It shall be agreed to by all parties that the Water Department of the City of Farmington, Missouri shall have full authority of inspection at all times during the progress of any water main work. The inspector shall have full authority to inspect the materials and the work performed.

2. The contractor shall furnish all reasonable aid and assistance required by the Engineer or his aides, for the proper inspection and examination of the work and all parts thereof. The contractor shall regard and obey the directions and instructions of the Engineer or inspector so appointed, when the same are consistent to his contract or these specifications; however, should the contractor object to any order given by any inspector, he may object by written appeal to the Director of Public Works of the City of Farmington, Missouri, or his duly appointed representative.

3. Supervising engineers, inspectors, and other properly authorized representatives of the owner or City shall be free at all times to perform their duties, and intimidation or attempted intimidation of any one of them by the contractor or by any of his employees shall be sufficient reason, if the City so desires, for suspension of work.

4. Such inspections shall not relieve the contractor or owner from any obligation to perform his work in accordance with these specifications or approved plans, and work not so constructed shall be removed and made good by the contractor or owner at his own expense, whenever ordered by the inspector without reference to any previous oversight or error in inspection.

5. The Engineer or inspector shall have full authority to immediately and "on the spot" suspend work on any job or site for any reason and/or direct changes or alter specifications as they dictate.

6. The contractor shall notify the Engineer or his aides for the availability of an inspector a minimum of two working days before commencing work. Monday through Friday between the hours of 7:00 a.m. and 3:30 p.m. shall constitute a typical work week. Any work outside these hours, or on holidays recognized by the City of Farmington, requires the approval of the Engineer or inspector. A minimum of two days notice will be required when requesting inspection services outside of normal working hours.

Q. Measurement and Payment

1. Scope: This section is not-applicable to water mains extended under the provisions of the "APPLICATION FOR PERMISSION TO EXTEND WATER MAIN" (Developer Extensions). This section covers methods of measurement and payment for items of Work under this Contract.

2. General: The total Contract Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plans, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

3. Estimated Quantities: All estimated quantities stipulated in the Bid Response or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise on

account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

4. Excavation and Trenching: Except where otherwise specified, the unit or lump sum price bid for each item of Work which involves excavation or trenching shall include all costs for such Work. No direct payment shall be made for excavation or trenching. All excavation and trenching except rock excavation shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth.

5. Rock Excavation: Rock excavation shall include any excavation which requires the contractor to utilize equipment intended specifically for the removal of rock which encompasses a volume of 1/2 cubic yard or greater amount of rock measured in its original and undisturbed state. Removal of igneous, metamorphic, or sedimentary rock or stone, boulders over two cubic yards in volume in open areas and one cubic yard in volume in trenches; and masonry, concrete, or solid frozen soil that cannot be removed by an excavator with an operating weight of at least 52,600 pounds and flywheel horse power of at least 153 HP, by rippers or other mechanical methods and, therefore, requires drilling and blasting. The unit price bid for each item of rock excavation shall include the excess cost only of the removal and subsequent handling of such rock, over and above that of earth excavation. Trench width and depth in rock shall meet the minimum requirements specified in Section H and rock excavation pay quantities shall be based on the volume of the excavated material in its original and undisturbed condition with the following maximum limits. For pipe with a 10-inch diameter or less the payment for rock excavation shall be based on a trench width of 2 feet. For pipe having a nominal diameter larger than 10 inches, payment for rock excavation shall be based on a trench width 12 inches wider than the outside diameter on the pipe. Payment for rock excavation at air release manholes or other structures shall be based on the outside diameter or dimensions of the structure plus 4 feet. Maximum trench depth shall be 6 inches deeper than the pipe depth required. All rock measurement or estimates to be used for payment purposes shall be made, recorded, and signed in the field in the presence of the Engineer and contractor or their duly authorized representatives. When a contract unit price for rock excavation is not included in the contract, the payment for rock excavation shall be equivalent to the current rate for Class 3 Excavation in Rock included in the Missouri Department of Transportation's Specification Book for Highway Construction.

6. Pipelines: Ductile iron pipelines which are to be paid for on a unit price basis shall be measured for payment on a horizontal plane after installation of the pipe. Where lines are laid to conform to stationed profiles, payment shall be made on linear quantities based on the pipeline stationing as determined by surveys made after installation. The measurement of the length of each line or run of pipe of each size will begin and end at:

   a. The end of the pipe where connected to an existing pipe, fitting, or valve; or at the end of a dead-end run.

b. The center line intersection of run and branch on tees, crosses, or laterals where a branch line connecting therewith is constructed under this Contract. Where a branch fitting is installed under this Contract, and the branch or connecting line is to be constructed by others at some future date or under another contract, the pay measurement will include the entire laying length of the branch or branches of such fitting.

c. The measurement of each line of pipe of each size which is to be paid for on a unit price basis will be continuous through, and shall include the full laying lengths of, all fittings and valves installed between the ends of each line; except that the laying lengths of reducers and increasers will be divided equally between the connected pipe sizes. Connected piping for fire hydrants will be measured for payment from the center of the main to the center of the auxiliary gate valve.

d. Connections to Existing Water Mains: Connections to existing water mains will be paid for at the lump sum prices bid. Each lump sum price named for a connection shall include all costs incurred for making the connection over and above the price of the connecting piping in place. Each lump sum price shall include furnishing and installing the tapping sleeve and valve, all excavation and backfilling work, all necessary thrust restraints and all other costs not included under other bid items. Tapping of existing main, and the costs associated with the tapping procedure, shall be the responsibility of the Water and Light Department unless otherwise stipulated in the Contract documents.

e. Gate Valves: Gate valves in water mains will be paid for at the unit price bid for each size. The unit price shall include all costs incurred in completing the gate valve installation over and above the amount paid for piping in place. The unit price shall include furnishing and installing the gate valve, valve box, and appurtenances; excavation and backfill not included under piping; and all other costs not included under other bid items. No separate payment will be made for fire hydrant auxiliary gate valves or tapping valves.

f. Fire Hydrant Assemblies: Fire hydrants will be paid for at the unit price bid. The unit price named for each fire hydrant installation shall include all costs incurred in installing the fire hydrant; furnishing and installing hydrant, tee, auxiliary gate valve, accessories, and appurtenances; concrete blocking; drainage facilities; and all other costs not included under other bid items.

g. Fire Hydrant Assembly Relocation: Existing fire hydrants indicated on the drawings to be relocated will be paid for at the unit price bid. The unit price bid for each fire hydrant assembly relocation shall include removing the existing fire hydrant. The unit price bid shall also include furnishing and installing a mechanical joint end cap or plug at the main, new tee, auxiliary gate valve, accessories and appurtenances, concrete blocking, re-installation in accordance with paragraph 5.03 above and all other costs not included under other bid items.

h. Fittings and Tees: The unit price bid for fittings and tees shall be the additional cost of such fitting or tee over and above that of an equivalent length of pipe and shall include all necessary thrust restraints.

i. Site Restoration, Seeding, and Sodding: No separate payment shall be made for site restoration seeding, or sodding as specified or required. All costs in connection with restoration, seeding, and sodding shall be included in the cost of the pipe.

7. Cased Bore: Where tunneling is required in connection with highway or primary road crossings, each crossing shall be measured for payment horizontally along the longitudinal center line of the enclosing conduit or pipe installed there, from end to end of the enclosing conduit or from end to end of the tunnel excavation where an enclosing conduit is not required. Each designated type of crossing shall include the unit price bid for each crossing in pipe conduit or tunnel liner shall include all costs in connection with excavation and backfilling, pipe conduit or tunnel liner, the excess cost of installing pipe in pipe conduit or tunnel liner above the amount bid for the pipe laid in open trench, all skids, jointing materials, jacking pipe, jacking pits, sand backfill, end closures, and all other work for and in connection with the crossing, not paid for separately.

8. Pavement Removal and Replacement: Pavement removal and replacement shall be measured in place and the areas computed in square yards. The area measured shall be the actual areas required or as ordered by the Engineer. If additional surface is removed or damaged due to the negligence on the part of the Contractor, the additional quantities shall not be measured for payment, but shall be done at the Contractor's expense. The unit prices bid for pavement removal and replacement shall include all costs in connection therewith, including cutting, removal, and disposal of old pavement; construction of new pavement; and all extra compaction effort required for backfill beneath pavement.

9. Traffic Control: Signs and other traffic control devices required for traffic control during construction will be paid for at the lump sum price for traffic control. This item includes the submittal of a traffic control plan.

10. Miscellaneous Concrete: No separate payment shall be made for concrete for encasement or blocking of pipe and fittings or thrust collars at valves not included as parts of manholes and other structures. All concrete which is required in connection with manholes or structures, pavement or sidewalk replacement, and other pay items shall be included in the lump sum or unit price bid for the pay item.

11. Cleaning, Pressure and Leak Testing: Will be as specified and will be paid for at the unit price bid. The unit price bid shall include all materials and equipment needed to perform the specified functions including but not limited to pigs and pig assemblies, temporary water supply taps, pumps, gauges and other testing equipment. It shall be the responsibility of the contractor to ensure the main is properly cleaned by pigging and flushing, that it is pressure and leak tested as required and any repairs made to ensure compliance with the listed allowable leak schedule.

12. Disinfection: Disinfection will be done in accordance with Section M (paragraph 2) and will be paid for at the unit price bid. The unit price bid shall include all materials and equipment needed to perform the required functions but is not limited to temporary water supply taps, chlorine, neutralizer, pumps, gauges and other testing equipment. It shall be the responsibility of the contractor to ensure that the main is disinfected and flushed so as to pass the required bacteriological testing all for the unit price bid. No increase in allowances will be made for repeat of any function to ensure compliance with the specifications.

Section 427.040. Sanitary Sewers

Sanitary sewers covered in these specifications drain to the east wastewater treatment plant (MO-0028860) and the west wastewater treatment plant (MO-0040312).

A. Sewer Pipe

1. Scope of Work. The work shall consist of furnishing all materials, equipment, and labor necessary for the construction of sanitary sewer lines and accessories in conformance with the lines and grades shown on the pians or as established by the Engineer, and as specified herein. Items of work or materials not specifically mentioned, but necessary for the completion of the sanitary sewer line construction shall be considered as incidental to other items in the contract.

2. Materials.

a. Pipe. The type, size, and class of pipe shall be shown on the plans. Type, size, or class of pipe may not be changed during the progress of the work without approval of the Engineer. The pipe, type, and class shall be one of the following:

1. "Wye" Service Connections shall be an approved molded tee made of the same material as the sanitary sewer. Molded tees shall be used on all new sewer lines. An InsertaTee or strap-on tee may be used only when connecting to an existing sanitary sewer, with the approval of the Director of Public Works.

2. Cast or Ductile Iron Pipe and fittings shall conform to United States of America Standards Institute, Specifications A-21, Class 50 with mechanical joints or slip on joints.

3. Polyvinyl Chloride (PVC) Sewer Pipe shall conform to ASTM D3034 (SDR 35) or HDPE. Fittings shall conform to ASTM D3034 (SDR 35) or as otherwise shown on the Standard Drawings.

4. SDR 35 Poly Vinyl Chloride (PVC) Connections shall be molded tees. Molded tees shall be used on all new sewer lines. Compression locking tees are to be used on existing lines, unless saddles are requested by Engineer. An approved long skirted

strap-on saddle type connection will be allowed on existing sanitary sewer lines only.

5. SDR 21 Class 200 Poly Vinyl Chloride (PVC) Sewer pipe shall conform to ASTM D2241. Fittings shall conform to ASTM D2241 or as otherwise shown on Standard Drawing.

6. SDR 21 Class 200 Poly Vinyl Chloride (PVC) Connections shall be molded tees. Molded tees shall be used on all new sewer lines. Compression locking tees are to be used on existing lines, unless saddles are requested by Engineer. An approved long skirted strap-on saddle type connection will be allowed on existing sanitary sewer lines only.

   All pipe and connections will require a certification, from the supplier, stating that the material supplied meets all applicable specifications. The certification will be required on or before the material is delivered to the job site.

b. Pipe Joints.

   1. Joints for cast or ductile iron pipe shall conform to USASI specification A21.11 for mechanical or push-on joints.

   2. Joints for PVC pipe shall conform to ASTM D3212

c. Couplings. (A mechanical device for joining parts together.)

d. Bedding and Backfill. All required bedding and backfill material shall be considered incidental and no additional payments will be made for these items.

PIPE DIAMETER	GRANULAR MATERIAL
Less and 8"	Type 5
10" and greater	1" Minus

e. Miscellaneous Materials. Any materials requested by the contractor for use during construction but not described in this specification will be subject to the approval or rejection of the Engineer.

3. Construction Methods.

   a. Classification of Excavated Materials will be made as follows:

      1. Rock is defined as sandstone, dolomite, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges 6 inches or more in thickness, or similar material in masses or boulders, each being more than 1 ½ cubic yards in volume. Removal of igneous, metamorphic, or sedimentary rock or stone, boulders over two cubic yards in volume in open areas

and one cubic yard in volume in trenches; and masonry, concrete, or solid frozen soil that cannot be removed by an excavator with an operating weight of at least 52,600 pounds and flywheel horse power of at least 153 HP, by rippers or other mechanical methods and, therefore, requires drilling and blasting.

Should rock be encountered in two or more ledges, each ledge being more than 6 inches thick and with interlying strata of earth, clay, shale, or gravel not more than 12 inches in each stratum, the entire volume between the top of the upper ledge and bottom of the lower ledge will be classified as rock.

2. Earth. All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hardpans) shall be considered as earth.

3. Unclassified excavation will consist of the excavation of all materials of whatever character encountered in the work. All material required to be excavated will be considered as "Unclassified Excavation" unless the contract specifically states otherwise.

b. Excavation shall consist of the removal of any and all material below ground level necessary in order to carry out the installation and construction required by the plans and specifications and shall include: (1) Additional excavation required for bedding; (2) All sheeting, shoring, bracing, protection of adjacent property and underground conduits or structures and preparation of the sub-grade; (3) The cost of diversion of surface water, pumping, draining or otherwise de-watering of excavation; and (4) The subsequent handling and disposal of such material not used in the backfill.

Trench excavation shall not be performed any farther ahead of the bedding and pipe laying operations than is necessary to permit a continuous operation. The elevation of the bottom of the trench shall be continually checked for conformance to the lines and grades shown on the plans. Excavation made below proper sub-grade elevation shall be refilled with bedding material and thoroughly compacted at the contractor's expense. Sheeting, timbering or bracing shall be placed by the contractor wherever necessary for the safety of workmen or the public and for the preservation of any excavation, embankment, or structure. Where the excavation is of such an unstable character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final trench elevation as required for stability. The contractor shall be held responsible for the determination of the need for sheeting or other types of protection and for the sufficiency of all sheeting and bracing used and for all persons injured or property damaged as the result of improper quality, strength, placing, maintaining, or removing the same. No additional compensation will be made for any sheeting, bracing, or other protective measures whether left in place or not.

The contractor shall, at his own expense, shore up and protect from damage all buildings, retaining walls, viaduct piers and footings, storm sewers, sanitary sewers,

gas lines, water lines, fences, curbs, trees or other property liable to be damaged during the progress of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work.

The contractor shall furnish and operate sufficient pumps and equipment, and shall provide all materials, labor, etc., required to prevent interference with the work by water, ice or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of proper protection of the work shall be repaired or replaced by the contractor at his own expense.

Where leaks or springs are encountered which, in the opinion of the Engineer, affect the safety, usefulness or satisfactory operation of any of the permanent work, he may direct special precautions to be taken.

The width of the trench at the top of the pipe shall be a minimum of 1.4 times the pipe diameter plus 12 inches.

The location of sewers and structures as shown on the plans have been selected to provide the least possible interference with or the crossing of existing utilities and aboveground obstructions. The City reserves the right to make minor variations in the location of the sewers and structures during the construction to adjust for any changed conditions discovered and no additional payment will be allowed the contractor for shifts in alignment.

Arrangements shall be made by the contractor with all persons, firms, corporations owning or using any poles, pipes, tracks, or conduits, etc., affected by the construction on this project to maintain and protect such facilities during construction with the cost of any such protection paid by the contractor and considered as incidental to other items in the contract.

For requirements relating to the use of explosives, refer to the General Conditions.

Tunneling shall be done only where shown on the plans or by written direction or approval of the Engineer. Tunnels shall be of sufficient size, height, and width to permit proper installation of the pipe, proper bracing of the tunnel section and to permit ample room for the prosecution of the work and safety of the workmen.

Boring installations are made where pipelines must pass under airport runways, highways, railroad tracks, and other locations where conditions prevent the use of "open-cut" excavation. Accuracy in alignment and grade of the casing pipe is very important in maintaining the established invert grade of the pipeline to be inserted. Proper grade of the inserted pipe is a must for satisfactory operation of the gravity flow line.

c. Bedding and Laying Pipe. The subgrade of the trench shall be excavated to a depth so as to provide space for at least Six (6) inches of bedding material between the

subgrade and the pipe. Bedding material shall be placed in the trench and carefully graded and compacted to the proper elevation so that the pipe, when placed, shall conform to the specified line and grade. The Engineer or Survey Crew will initially provide the contractor with line and grade stakes set on the natural ground surface. It shall be the contractor's responsibility to transfer the line and grade to the bottom of the trench. A laser beam shall be used for this purpose or some other method of checking the pipe grade and line approved by the Engineer in writing. The contractor must verify the trench grade or the grade of the top line and sewer pipe, and will be held responsible for the correct flow of sewers. Any apparent inaccuracy in the grade stakes shall be called to the Engineer's attention immediately upon discovery.

If, in the opinion of the Engineer, subgrade conditions are such that the bedding described above will not adequately support the pipe, he may order the contractor to install concrete cradles.

At locations where it is necessary to construct the sewer line across an existing water line and there is less than an 18-inch vertical distance between the top of the lower line and the bottom of the upper line, the sewer line shall be constructed of Class 200 pressure water line pipe and must be air tested at a pressure not less than four (4) pounds per square inch for five (5) minutes to assure water tightness. A manhole or approved adapter must be located at each end of the pressure pipe; and, the near side of the manholes can be no closer than ten (10) feet from the water main. When the elevation of the sewer cannot be verified to meet the above requirement, the water main or sewer shall be relocated to provide this separation. If a water line is parallel to the sewer line and located within ten (10) feet horizontally and eighteen (18) inches vertically, the sewer line shall be constructed as set out above for vertical separation.

Unless approved by the Director of Public Works, sanitary sewers shall not be constructed with less than three (3) feet of cover over the top of the pipe. If less than three (3) feet of cover is allowed and the sewer is under the pavement or the near side of the sewer trench is within two (2) feet of the curb, then cast iron or ductile iron pipe, as described above, will be required. If no portion of the sewer trench is within two (2) feet of the curb and less than three (3) feet of cover is allowed, then Class 200 pressure water line pipe will be required.

If more than twelve (12) feet of cover to the top of the sewer pipe is necessary for construction of the sewer line, then Class 200 pressure water line pipe will be required

Where high groundwater conditions are encountered or anticipated, mitigate pipe flotation during construction (such as dewatering, pipe anchoring, etc.) as necessary.

d. Laser.

The contractor shall provide and maintain in good working order, on the site, at all times, a laser beam. Each length of pipe shall be laid on an even, firm bed, so that no uneven strain will exist to prevent the pipe from bearing on the sockets. Bell holes for

bell and spigot pipe shall be dug at each joint as hereinbefore specified. Each pipe shall be laid in conformity with the line and grade stakes given by the Engineer. Pipe laying shall commence at the manhole connection at the low point of the project and progress up grade, unless otherwise expressly permitted by the Engineer. The bell- end of the pipe shall be laid up grade. The alignment of all pipelines between adjacent manholes shall be true to line and grade. The pipeline from manhole to manhole shall reflect the full bore of the pipe. The end of each joint pipe shall be truly centered and fully positioned into the abutting pipe. Pipe laid in the trench shall not be covered until approved by the Engineer or Inspector.

The laser beam used to control line and grade for the pipe-laying operation must be verified at the beginning of each day, at least once between manholes, and at any other time the Engineer or Inspector deems necessary to ensure the proper line and grade of the pipe.

e. "Wyes".

On all sewers serving individual lots, one (1) molded tee for lateral sewer or house connection shall be furnished and should be laid to center of every lot where possible, extending 5' onto property. Additional tees may be required for unplatted areas and large lots, as the Engineer directs. They shall be four (4) inches in diameter unless otherwise shown on the plans or specified by the Engineer and shall be capped or plugged in accordance with manufacturer's recommendations. No saddle tees will be accepted on new sewers. A general purpose, flexible marker shall be placed at the end of each tee location.

The exact location of all tees shall be carefully ascertained by the Engineer or Inspector before concealment by backfilling, by accurate measurement from the center of the manhole downstream in the same line of pipe so that a true and exact record may be preserved for future use. No tees will be permitted to connect to the main opposite each other. The minimum distance permitted between tees shall be two (2) feet.

f. Laterals.

All lateral shall have a minimum of ¼-inch per foot slope, unless otherwise approved. On PVC tees and lateral lines, all joints must be glued with an approved adhesive. The plans shall show the stationing of all in-line tees and shall be placed as near as possible to the center of the lot, so as to provide maximum clearance for driveways and utility lines. All PVC laterals shall be Schedule 40 pipe.

No more than 700 feet of sewer line shall be constructed prior to commencing construction of laterals. At the option of the contractor, construction of the sewer lines and laterals may be performed concurrently. If, in the opinion of the Engineer, the lateral construction is not proceeding in a timely manner, the Engineer may order the

contractor to cease work on the sewer line construction until such time as lateral construction has proceeded to a point satisfactory to the Engineer.

If the sewer is being constructed within the street right-of-way, all laterals shall extend to 5' past the right-of-way line. All laterals within street right-of-way shall be a minimum of four (4) feet deep at the right-of-way line. It will be the responsibility of the contractor to ensure service to each property. If the main sewer line is deep enough, then service shall be provided to basements. If a tee is to be placed but no lateral is required on a main sewer line eight (8) feet or more in depth, a four (4)-inch riser shall be placed, bringing the connection to a maximum depth of seven (7) feet below finished ground level. This riser will be measured and paid for as lateral line.

No lateral can be located within two (2) feet of a manhole or connected into a manhole without approval of the Engineer. If lateral is to be connected to an existing manhole, the manhole shall be cored and fitted with an insert-a-lock or approved equal.

Any lateral connected to a manhole shall have an approved channeling device. Refer to Standard Drawing San-6 or Chapter IV, Construction Methods (Inverts).

A general-purpose flexible marker shall be required at the end of each lateral, extending 1' above finish grades.

Before backfilling, laterals shall be plugged or capped in a manner acceptable to the inspector.

g. Cleaning.

The interior of the sewer line shall, as the work progresses, be cleaned of all dirt and other foreign material. On small pipe sewers where cleaning after laying may be difficult, a swab or drag shall be kept inside the pipeline and pulled forward past each joint immediately after its completion.

At the end of each workday, the end of the sewer pipe or manhole shall be plugged or capped to prevent the intrusion of water, dirt, gravel, and all other foreign material. At the beginning of each workday, the trench shall be dewatered (by pumping) before opening the end of the sewer pipe. The end of the pipe shall be cleared to prevent the intrusion of foreign material.

Note: If the City Forces are hired to clean and flush lines, a minimum of four (4) hours will be charged to the contractor.

h. Joints.

Joints for reinforced concrete pipe with flexible rubber gaskets shall be made in accordance with manufacturer's recommendation. Bell and spigot, or tongue and

groove ends of the pipe shall first be wiped clean before actual jointing operations are started.

Immediately prior to jointing, all surfaces of the joint shall be thoroughly cleaned and lubricated with soapy water or in accordance with manufacturer's recommendations. The tongue end shall be centered on grade into the groove end of the last downstream length of pipe and shoved completely home and properly seated with the application of steady pressure by a lever, winch, or other suitable device. Care shall be used to prevent displacement of the gasket during jointing.

Mechanical joints for cast iron pipe or D.I.P. shall be carefully assembled to assure that the two ends will be centrally located in the joint. The surfaces coming in contact with the rubber gasket shall be thoroughly cleaned with a wire brush just prior to assembly to remove all loose rust or foreign materials, and the gasket brought toward the flange evenly by partially tightening the bottom and top bolts, then the side bolts, and last, the remaining bolts. The cycle should be repeated until all bolts are properly tightened. If effective sealing is not attained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Overstressing on bolts to compensate for improper installation will not be permitted.

i. Backfilling.

The backfilling of the trench shall follow closely behind the pipe-laying operation, but not until inspected by the Engineer or Inspector and the location of all connections recorded. In all cases, the pipe shall be backfilled the same day as laying.

The backfill material around the sewer pipe and lateral, to a height of twelve (12) inches above the top of the pipe, and from trench wall to trench wall, shall be aggregate bedding material, as specified hereinbefore, carefully placed and compacted so as not to disturb the pipe location. In any trench where the flowline of the sewer is more than twelve (12) feet below finish grade, then the backfill around the pipe and to a height of twelve (12) inches above the top of the pipe, shall be aggregate bedding material.

For the backfill material for sewers and laterals constructed in open cuts crossing or parallel to roadways, driveways, sidewalks, other existing pavements, or having the near side of the trench walls within two (2) feet of back/bottom of street curb, and at other locations shown on the plans or specified, all of the backfill shall consist of granular material meeting the requirements for bedding material, specified hereinbefore. This material shall be placed and thoroughly compacted.

Except as specified above, the backfill material may be suitable earth material from the excavation. No frozen material shall be used in the backfill. No rocks in the backfill material shall exceed 6" in diameter in any direction. Care shall be taken to avoid injury to the pipe, structure, or producing unequal pressures thereon. Earth backfill shall be compacted to 95% of the Standard Proctor Density (ASTM D698). The top

four (4) inches of the backfill shall be made with topsoil and graded as required under Chapter III of these specifications.

Note: Flowable fill must be approved by Director of Public Works.

j. Jetting. Earth backfill may not be compacted by jetting the material.

k. Mechanical Compaction. Any acceptable mechanical compaction method may be used to achieve minimum compaction requirements. At the discretion of the Engineer, any project within the City of Farmington may require testing by an independent testing laboratory at the expense of the contractor. Minimum compaction shall be 95% standard proctor in accordance with ASTM D698.

All surplus excavation material not used in the backfill shall be disposed of by the contractor at his expense. Upon receipt of written notice from the Engineer, any settlement of the backfill below the original ground surface shall be remedied by the contractor for a period of one (1) year after final completion and acceptance.

l. Tunnels. The backfill material for all sewers laid in tunnels shall be sand or finely crushed dolomite of which one hundred (100) percent shall pass a 3/16-inch sieve. The backfill shall be thoroughly compacted or blown in.

m. Pavement Replacement.

1. Temporary Replacement. If for any reason a roadway must be opened for traffic, after the sewer is in place but before the pavement is replaced, then the contractor must provide a one (1)-inch asphalt cap on the trench backfill within 24 hours. This asphalt cap shall be the contractor's responsibility and no additional compensation will be allowed. Backfill and/or asphalt shall be removed as necessary prior to placement of the permanent pavement.

2. Permanent Replacement. All pavement and curbs damaged during construction, in the opinion of the Engineer or Inspector, shall be removed and replaced. In order to determine the amount of damage to the pavement and curbs during construction, all existing cracks in the street or curb should be marked/painted in advance of construction. Permanent pavement replacement shall not occur any later than thirty (30) calendar days after backfilling, unless otherwise approved by the Engineer.

The existing pavement necessary to be removed for construction shall be sawed in a neat line and removed prior to excavation. The width of this removal will be specified in the special provisions and payment for pavement repair shall not exceed the width specified.

The paving shall be sawed prior to replacement as to ensure a straight edge and a uniform patch. The subgrade for the new paving shall be further compacted by rolling or tamping. The pavement shall then be re-laid carefully in accordance with

the requirements of the section of the materials specified. The minimum required thickness of pavement replacement shall be either six (6) inches of concrete for concrete surfaces or six (6) inches of concrete and two (2) inches of asphalt surface course for bituminous surfaces.

4. Method of Measurement.

   a. Pipe. Final measurement of all pipe will be to the nearest foot.

   b. Encasement. Final measurement of all encasements will be to the nearest foot.

   c. Rock Excavation. Final measurement of rock excavation, if specified, will be to the nearest cubic yard.

   e. Pavement Replacement. Final measurement of all pavement will be to the nearest square yard within a maximum trench width of six (6) feet unless otherwise specified or approved by the Engineer.

5. Basis of Payment.

   Contractor will be paid for quantities actually constructed or performed as determined by field measurement at the unit price bid for the items listed in the schedule of the proposal or for such extra work as may be authorized and approved by the Engineer. The cost of incidental work not listed in the schedule of the proposal but necessary for the completion of the project shall be considered as completely covered by bid prices for other items in the contract.

   Quantities of work acceptably completed under the terms of the contract shall be determined by the Engineer based on his actual measurements.

   a. Sewer Pipe in place will be paid for on horizontal length of sewer laid from inside edge of manhole or structure to inside edge of manhole or structure and shall include the cost of all labor, materials, including joints, tee branches, and other necessary fittings, excavation, backfill, rough grading, testing, and equipment.

   b. Lateral Pipe in place will be paid for on length of lateral laid from tee or wye to end of lateral. Unit price for laterals shall include the costs of all labor, materials, joints, and necessary fittings, excavation, backfill, rough grading, testing, and equipment.

   c. Concrete Encasement will be paid for at the bid price per lineal foot, or as extra work if not listed in the schedule of the proposal.

   d. Rock Excavation. Rock excavation, if specified, will be calculated at a width of three (3) feet for pipe up to and including twenty-four (24) inches in diameter. For pipe having a diameter greater than twenty-four (24) inches, the trench width to be paid for

will be calculated as the pipe width plus six (6) inches on each side of pipe. Unless specified, no payment for rock excavation will be made.

B. Manholes

1. Scope of Work. The work shall consist of furnishing all materials, equipment, and labor necessary for the construction of manholes and accessories at the location and in accordance with the details of the plans and as specified herein. Manholes shall be of the precast-concrete or poured-in-place concrete type. Items not specifically mentioned, but necessary for completion of the work shall be considered as incidental to other items in the contract.

2. Materials.

   a. Concrete for manhole bases, pipe encasement, or cradle shall conform to the requirements of Chapter IX of these specifications except that the slump shall be four (4) inches plus or minus one (1) inch.

   b. Cast iron fittings and piping with mechanical joints shall be in accordance with USASI Specification A21, Class 50 and the plan details.

   c. Cast iron frames and covers shall conform to the requirements of the Standard Drawing San-2.

   d. Precast concrete manholes shall receive an application of asphaltic water proofing paint on the exterior at the plant site.

3. Construction Methods.

   a. If manholes are constructed of precast sections, each precast section shall be set in a preformed, bituamastic gasket material. A minimum of 6" bedding material shall be used under manhole base.

   b. Inverts shall be precast or constructed with cement mortar after all precast sections are in place. Inverts shall be smoothly finished to assure smooth flow through the manhole with a minimum of two-tenths fall across the manhole and in accordance with the plans.

   c. The elevation of manhole cover shall be adjusted to the required grade by shimming with concrete ring laid in a bitumastic material. Frame and cover shall be Neenah Type R-1642 or approved equal in all areas.

   d. Manholes shall be waterproofed on the exterior. Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place.

e. Cold Weather Requirements. Whenever the temperature of the surrounding air is below 40 degrees F, or when the possibility exists that the temperature will fall below 40 degrees F within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature between 80 degrees F and 100 degrees F. All concrete shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours, and shall be protected from freezing for at least an additional 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing shall remain in place and intact for at least 24 hours after the artificial heating is discounted. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations.

f. Finishing. The top surfaces of structures shall be struck off with a straight edge and finished with a wood float. Forms will be removed between 12 and 24 hours, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

g. Curing. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with plastic sheet, or covered with earth and/or burlap, or when not required to be painted, sprayed with liquid conforming with ASTM C309.

h. Backfilling. Manholes, which lie within an area to be paved, shall be backfilled with granular material meeting the requirements for bedding materials specified hereinbefore. This material shall be placed and thoroughly compacted. All other manholes shall be backfilled with earth materials and shall be placed and jetted in the same manner as for sewer lines, specified hereinbefore.

i. Removal of Forms. Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather, and other conditions influencing the setting of the concrete, and the requirements for curing and finishing.

4. Method of Measurement. Manholes exceeding eight (8) feet in depth will be measured to the nearest 1/10 foot.

5. Basis of Payment. Manholes up to six (6) feet in depth include all labor, equipment, materials, backfill, excavation, concrete base, cone, ring, and cover, and all fittings and appurtenances for sealing the manhole or construction drops associated with the manhole and acceptance testing, as well as the sidewalls, and will be paid for at the base price of each manhole complete in place. Additional payment will be made for any depth over six

(6) feet at the unit bid price per vertical lineal foot. All excavation for manholes shall be included in the unit price per manhole. No direct payment will be made for furnishing and placing asphaltic paint, premolded, asphaltic filler, or other types of joint separators. Therefore, the cost shall be included in the price bid for the item of work of which they are apart.

C. Manhole Adjustment

1. Scope of Work. The work shall consist of the adjustment of sanitary sewer manhole frames and structures within the construction area to the lines and grades shown on the plans or as established by the Engineer.

2. Materials. The following materials may be used in adjusting the grade of the manhole tops:

   a. Precast Reinforced Concrete (Adjustment Rings)
   b. Manhole sections per ASTM C478
   c. Preformed Flexible Joint Material per AASHTO designation M-198

3. Construction Methods. The grade of a manhole may be raised a maximum of one (1) foot by removing the frame and building up with precast concrete adjustment rings. The frame shall be reset in preformed flexible joint material. Where required to raise the grade of a manhole more than one (1) foot, the contractor shall be required to remove the cone section of the manhole, add a barrel section approximately the height of the grade change, and replace the cone section and necessary adjustment rings, etc. as directed by the Engineer.

   Where it is required to lower the grade, (unless there is a sufficient height of precast concrete adjustment rings in place above the cone section which can be removed) the cone section and a sufficient number of barrel sections shall be removed and the cone section replaced or changed as directed by the Engineer. Reconstruction of the manhole shall be in accordance with applicable requirements of Sanitary Sewer Construction in Chapter VI, paragraph B of these Specifications.

   The existing manhole ring and lid shall be removed and placed in a location designated by the Inspector and become the property of the City. A new standard manhole Type A ring and lid shall be installed on the manhole as a part of the adjustment.

4. Basis of Payment. Manhole adjustments for sanitary sewer manhole frames and covers shall be paid for at the contract unit price of each structure. This shall include all labor, equipment, materials, including new ring and lid, and excavation, to complete the adjustments to the lines and grades shown on the plans or as established by the Engineer.

D. Sewage Lift Stations

1. Scope of Work. The work shall consist of the furnishings of all labor, equipment, tools, and materials to install sewage lift stations as required by the Plans, Special Provisions, and these Specifications. Lift stations shall consist of a wet well, submersible pumps, dry valve vault, control panel, dry well and other related accessories. The lift stations shall conform to MoDNR Design Guide per 10 CSR 20.8.130.

2. Pump Requirements.

   a. Furnish and install two (2) submersible non-clog wastewater pumps. Each pump shall be equipped with a minimum 5 HP submersible electric motor connected for operation on 480 volts, 3 phase, 60 hertz, 3 wire service, with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval.

   b. PUMP DESIGN CONFIGURATION - The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with a 304 Stainless Steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

   c. PUMP CONSTRUCTION - Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

      Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

      Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

   d. COOLING SYSTEM - Each unit shall be provided with an integral motor cooling system. A motor cooling jacket (on pumps greater than 10HP) shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. The cooling jacket shall be constructed of Stainless Steel or Cast Iron.

(Carbon Steel Cooling Jackets are not acceptable.) An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F. (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

e. CABLE ENTRY SEAL - The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

e. MOTOR - The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The motor shall be rated for Class 1 Division 2 hazardous locations. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient

and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

g. BEARINGS - The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

h. MECHANICAL SEAL - Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide seal ring. The inner (upper) seal shall incorporate the active seal technology. The upper seal shall prevent liquid from entering the dry motor housing. The rotating seal ring of the inner (upper) seal shall be laser inscribed with micro-grooves on the seal face. Should fluid pass the lower seal, enter the seal buffer chamber and approach the upper seal, the inner (upper) seal shall unit shall act as a micro-pump, preventing fluid from passing the upper seal and entering the dry stator housing.

Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with an lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant

expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

Seal lubricant shall be FDA Approved, nontoxic.

i. PUMP SHAFT - Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. If a shaft material of lower quality than stainless steel – ASTM A479 S43100-T is used, a shaft sleeve of stainless steel – ASTM A479 S43100-T is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless steel sleeves will not be considered equal to stainless steel shafts.

j. HARDENDED IMPELLER - The impeller shall be of ASTM A-532 (Alloy III A) 25% chrome cast iron dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the hard iron impeller shall be capable of handling gritty solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

k. VOLUTE / SUCTION COVER - The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be ASTM A-532 (Alloy III A) 25% chrome cast iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

l. MIX FLUSH VALVE SYSTEM - One pump shall be equipped with a Mix Flush Valve System that automatically flushes the sump during initial operation of the pump. The system shall consist of the Flush Valve, Impeller and Volute. The operation of the valve shall depend only on the pump flow and pressure. No electrical components or cables are to be used with the valve. Thus, the valve is intrinsically safe and suitable for pumps used in hazardous locations

m. PROTECTION - All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

A leakage sensor shall be available to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. USE OF VOLTAGE SENSITIVE SOLID-STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.

The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

3. Wet Well. The wet well shall be constructed of reinforced concrete, including a reinforced concrete bottom and top with access hatch.

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

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

The wet well shall contain stainless steel guide rails for the installation and removal of the pumps.

All exterior joints shall be sealed with heat shrinkable joint wrap conforming to ANSI/AWWA C-216. The wrap shall be Riser-Wrap Water Infiltration Sealing System as manufactured by Pipeline Seal and Insulator, Inc. or approved equal. All sealed joints are to be inspected by District personnel prior to backfilling.

The wet well shall have a 3" minimum diameter Type 304 stainless steel air vent extending through the top slab with a 180-degree turn. All vents shall have a charcoal filter at the end of the vent pipe. The filter shall be such that the filter material may be replaced without replacing the vent filter piping.

There shall be a stainless steel or aluminum trash basket located at the inlet pipe with a stainless-steel lifting chain to provide for periodic removal and cleaning.

Access to the wet well shall be through an aluminum hatch, rated for a 300-pound load, Halliday R2R or approved equal. The hatch shall be complete with hinges and flush locking mechanism, upper guide holder and level sensor cable holder. Doors shall open and automatically lock with stainless steel "hold open" arm with aluminum release handles.

Wet wells shall contain a form of fall protection around the access hatch meeting OSHA standards.

Manhole steps shall have a minimum width of 14 inches and be steel reinforced corrosion resistant polypropylene plastic.

4. Valve Vault. The valve vault for each lift station shall be pre-cast or cast in place reinforced concrete.

   Access to the valve vault shall be through an aluminum hatch, rated for a 300-pound load, Halliday S2R or approved equal. The hatch shall be complete with hinges and flush locking mechanism, upper guide holder and level sensor cable holders. Doors shall open and automatically lock with stainless steel "hold open" arm with aluminum release handles.

   Steps shall have a minimum width of 14 inches and be steel reinforced corrosion resistant polypropylene plastic.

   The valve vault shall contain two discharge lines from the pumps and each line shall have a horizontal swing check valve with an outside rotating arm indicator and a gate valve with a hand wheel operator.

   All piping and all fittings shall be flanged ductile iron and all piping shall be properly supported. Immediately beyond the valve vault, there shall be one 90-degree bend to bring the piping to a tee and then to the force main with a plug valve, immediately beyond the tee, with a valve box for operation from the ground surface. There shall be a provided minimum 2" schedule 40 PVC drain pipe from the valve vault to the wet well.

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

5. Dry Well. The dry well shall be pre-cast or cast-in-place concrete. The dry well shall have storage capacity to handle flows during peak demand period, during a power failure or other malfunction, of at least two hours. The dry well shall flow back into the wet well upon correction of the lift station malfunction or power failure. All joints and pipe openings shall be lined and sealed using approved liners and seals.

6. Wet and Dry Well Access. For Dry or wet wells that have mechanical equipment that require personnel to access equipment inside the structure, access shall be provided per 10 CSR 20.8.130. Section (4) Design, subsection (B) structures paragraph 3.

7. Electrical Equipment. All electrical equipment and wiring shall comply with the latest revision of the National Electrical Code. Particular attention should be given to electrical equipment enclosed in places where gases may accumulate (hazardous areas). Submersible pumps in lift stations are considered to be in a hazardous area and shall be

compliant with the NEC Class I, Group D, Division 1. This rating shall include pumps, removal systems, and controls. All conduit shall be of galvanized rigid type and shall be installed below grade wherever possible. Dry-type transformers for 110-Volt utility service and control systems power shall be provided as needed.

8. Alarm Systems. The alarm system is integrated into the SCADA system provided by the contractor selected by the City.

9. Emergency Power Supply. Provision of an emergency power supply for pumping station shall be made, and may be accomplished by connection of the station to at least two (2) independent public utility sources, or by provision of in-place internal combustion engine equipment which will generate electrical or mechanical energy.

10. Instructions and Equipment. A complete set of operational instructions for pump station and emergency power generation equipment, including emergency procedures, maintenance schedules, tools, and such spare parts as may be necessary, must be provided.

11. Fencing. A fence surrounding the station site shall be provided. The fence shall be eight (8) feet high (Minimum) with a twelve (12)-foot wide, double-leaf gate and a 3' wide personnel gate. The fence may be either galvanized chain link or wooden privacy type. Supporting posts for all types of fences shall not be more than eight (8) feet apart and be concrete encased below grade. Minimum bury depth to be two and one-half (2½) feet. Wooden fences shall be constructed of pressure treated or other approved weather resistant wood. Wooden support posts shall be 4" x 4" minimum. The gate is to be located so that entranceway does not go over manholes. Pump station and generator unit to be easily accessible for maintenance from entranceway. Gate to be set back twenty-five (25) feet from edge of road.

12. Outside Lighting. An outside weatherproof pole-mounted, LED lighting fixture with a minimum system wattage of 126 watts at 120 volts, color 5000K and with a photocell for dusk-to-dawn operation, on a dedicated circuit shall be provided. The height of pole shall be a minimum of 15' but shall be adequate to provide lighting for the entire site.

13. Enclosure. Enclosure shall be of sufficient area to provide a twenty (20) by twelve (12)-foot parking area and enclose all pump station buildings and equipment. A two (2) by four (4)-inch wooden header will be placed around the enclosure, inside the fence, and a four (4)-mil polyethylene sheeting shall be placed on the entire enclosed area and covered with at least four (4) inches crushed rock or gravel. Final wearing surface shall consist of 5" of bituminous asphalt pavement placed in 2 lifts per specifications for the City of Farmington alley streets.

14. Accessibility to Site. The pump station site must be accessible by an acceptable all-weather, hard surface road. Junction of pump station road and public street shall have a sixteen (16) –foot long culvert of acceptable diameter in ditch if necessary.

15. Locks. Locks shall be provided on all wet wells, dry wells. Two keys for each lock shall be furnished to the Owner at the time of final inspection. Gate lock latch to be a heavy duty fulcrum latch similar to Model #66RL1717 by KP Distribution, Inc. permitting operation from either side. Provide locking device and padlock eye as integral part of the latch, requiring one padlock for locking both gates.

16. Painting. All metal, except galvanized and stainless steel items which are not painted at the factory, shall receive a prime and finish coat of paint that is recommended for use in the environment in which the item is installed. Color to be determined by the Owner.

17. Surfacing of Lift Station Area. The area inside the fence must be constructed of four (4) inches of Type I aggregate on a four (4) mil polyethylene sheeting placed over the entire enclosed area with three (3) one (1)-inch holes per square yard. Prior to placing the sheeting, the soil to be covered is to be treated with a soil sterilant Diuron (Karmer by DuPont), or equal, and applied as directed by the manufacturer. Final wearing surface shall consist of 5" of bituminous asphalt pavement placed in 2 lifts per specifications for the City of Farmington alley streets.

E. Force Mains

1. Scope of Work. The work shall consist of the furnishing of all labor, equipment, tools, and materials to install force mains as required by the Plans, Special Provisions, and these Specifications.

2. Materials. Materials for pressure sewage force mains shall conform to the following standards:

   a. Polyvinyl Chloride (PVC) pressure pipe shall be SDR 21, Class 200 and shall meet the requirements of ASTM D2241.

   b. Ductile iron pipe shall meet the requirements of American National Standard Institute Specification A-21 .51 with push-on joints.

3. Combination Valve. Valmatic 800 Series, or approved equal, shall be placed at high points in the force main to prevent air locking. A standard four (4)-foot diameter manhole with standard frame and cover to be installed around force main and relief valve for maintenance access to valve.

4. Termination. Force mains should enter the gravity sewer system at a point not more than two feet above the flow line of the receiving manhole.

5. Bedding. Bedding shall be in accordance with required bedding specified for sewer pipe, hereinbefore.

F. Acceptance Tests for Sewers

1. Scope of Work. The work shall consist of the furnishing of all labor, equipment, tools, and materials, and the performance of any or all acceptance tests as required by the Plans, Special Provisions, and these Specifications.

2. General Requirements.

   a. The contractor shall furnish the Engineer or Inspector with every reasonable facility for ascertaining whether or not the work performed was in accordance with the requirements and intent of the plans and specifications. Any work done (except excavation) or material used without suitable supervision or inspection by the Engineer or Inspector may be ordered removed and replaced at the contractor's expense.

   b. After substantial completion of the work, which includes backfilling, compaction, and rough cleanup, or from time to time as the work progresses, the contractor shall, under the direction of the Engineer, make such tests of the entire work or any part thereof as may be required to demonstrate the efficiency of the sewer and accessories. If required, the contractor shall make such openings as the Engineer may direct and shall restore the part of the work so disturbed to the satisfaction of the Engineer. Should any part of the work be found faulty in any respect, the contractor shall repair such defects or replace them with new work as may be directed by the Engineer.

   c. The contractor shall provide facilities to the Engineer to make a visual observation test of the proper alignment of each section of sewer between two adjacent manholes.

3. Acceptance Tests for Gravity Sewers.

   a. Visual Inspection.

      1. Contractor shall clean pipe of excess mortar, joint sealant, and other dirt and debris prior to acceptance.

      2. The contractor will be required during construction to install a line throughout the entire length of mains within the sewer district. This line will be used for running a mandrel through the sewer lines. The ends of the line will be secured in a manner satisfactory to the Engineer or Inspector to ensure that the line will not be removed from the sewer before inspection. The line to be installed shall be one-quarter (1/4)-inch nylon or Polypropylene yellow or white rope.

      3. A mandrel will be furnished by the City for the contractor to use to mandrel all sewer lines in checking for the presence of any misaligned, displaced, or broken pipe, and the presence of visible infiltration, debris, or other defects. No pipe shall extend a deflection of five percent (5%). All mandrel testing must be done in the presence of the Engineer or Inspector.

4. The contractor shall correct all defects found during mandrel testing operations prior to conducting leakage tests.

b. Air Leakage Testing. An air leakage test shall be performed on the full length of all sewer lines and lateral lines prior to acceptance.

1. Contractor must perform air tests on all pipe less than eighteen (18)-inch diameter and may be required to perform air tests for all pipe sizes.

2. The contractor must furnish all facilities required, including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator to avoid over-pressurization, and all miscellaneous items required.

3. The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested, through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge readable from ground level indicating internal pressure in the sewer pipe. An additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.

4. The pressure test gauge shall meet the following minimum specifications:

Size (diameter)	4 to 4 ½ inches
Pressure Range	0 – 30 P.S.I
Figure Intervals	0.1 psi Increments
Pressure Tube	Bourdon Tube or diaphragm
Accuracy	+/- 0.04 psi
Dial	White coated aluminum with black lettering, 270 degree arc
Pipe Connection	Low male ½" N.P.T.

Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed. The test gauges shall be calibrated at least every six months.

5. The contractor shall test each reach of sewer pipe between manholes after completion of installation of all utilities.

6. The contractor shall plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. A 9.0 psig pressure relief valve is to be included for safety.

After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Size	Required Time Per 100 LF	Minimum Required Time
8"	38 sec.	7 min. 34 sec
10"	237.4 sec.	9 min. 26 sec.
12"	341.8 sec.	11 min. 20 sec.
15"	534.2 sec.	14 min. 10 sec.
18"	769.2 sec.	17 min. 00 sec.
21"	1,047.0 sec.	19 min. 50 sec.
24"	1,367.4 sec.	22 min. 40 sec.
27"	1,730.6 sec.	25 min. 30 sec.
30"	2,136.6 sec.	28 min. 20 sec.
33"	2,585.2 sec.	31 in. 10 sec.

If the air test fails to meet the above requirements, repeat test as necessary after all leaks and defects have been repaired. Prior to acceptance all constructed sewer lines shall satisfactorily pass the low- pressure air test.

7. In areas where groundwater is known to exist, the contractor shall install a one-half-inch diameter capped pipe nipple, approximately ten (10) inches long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed.

   Immediately prior to the performance of the acceptance test, groundwater level shall be determined by removing pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

4. Acceptance Tests for Force Mains. All force main piping shall be subject to a hydrostatic and leakage test.

a. Hydrostatic Tests: A two (2) hour test shall be made on each segment of the water lines between end points at a test pressure of 1.5 times the normal maximum operating pressure, not to exceed the design pressure of the pipe (200 psi for SDR 21 Class 200). The test pressure shall be determined by the City and suitable gauges for checking same shall be supplied and connected by the Contractor. A gate valve or pressure relief valves shall be supplied and connected by the Contractor. A gate valve or pressure relief fitting shall be placed at each end of the segment being tested unless otherwise directed. Allowable pressure drop during the two (2) hour test shall be limited to 3% of the test pressure.

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

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

The Contractor shall furnish the gauge and measuring device for the leakage test, as well as the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary labor to conduct the test. The duration of each leakage test shall be two hours, and during the test, the piping shall be subjected to a hydrostatic pressure of 1.5 times the normal maximum operating pressure of the pipe. Pressure should be maintained at a constant level throughout the testing period; the amount of water added to maintain this pressure shall be measured. If the amount of additional water introduced into the line during the test exceeds the testing allowance in the table below, the section of water main fails the acceptance test. The testing allowance provides for entrapped air, engagement of joint restraints, seating of gaskets, temperature variations and other minor variations; it is not intended to permit actual minor amounts of leakage. Should any tests of pipe installed disclose water loss greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the test is within the specified allowance.

Testing Allowance for PVC Pipe, U.S. gal/hr

Pipe size, in.	Average test pressure in line, psi				
	50	100	150	200	250
	Testing allowance/1,000 ft (50 joints)				
4	0.19	0.27	0.33	0.38	0.43
6	0.29	0.41	0.50	0.57	0.64
8	0.38	0.54	0.66	0.76	0.85
10	0.48	0.68	0.83	0.96	1.07
12	0.57	0.81	0.99	1.15	1.28
14	0.67	0.95	1.16	1.34	1.50
16	0.76	1.08	1.32	1.53	1.71
18	0.86	1.22	1.49	1.72	1.92
20	0.96	1.35	1.66	1.91	2.10
24	1.15	1.62	1.99	2.29	2.56
30	1.43	2.03	2.48	2.87	3.20
36	1.72	2.43	2.98	3.44	3.85
42	2.01	2.84	3.48	4.01	4.49
48	2.29	3.24	3.97	4.59	5.18

c. Tracer Wire Testing: Contractor shall perform a continuity test on all trace wire in the presence of the Engineer. If the trace wire is found to be not continuous, the Contractor shall repair or replace the failed segment of the wire and the run shall be re-tested.

d. Warranty: It shall be the responsibility of the owner or City's (whichever is applicable) contractor to maintain the main and the associated trench and construction area for one year after the acceptance of the main by the City. This responsibility shall not be limited to just faulty materials and workmanship but shall also include damage by other parties such as contractors and utilities. Damage to be within the scope of this responsibility include but is not limited to the cutting of the main by other utilities, theft of valve boxes and lids, over paving of valve boxes, misalignment of valve boxes and flush outs by construction traffic, crushing or misalignment of the main, valves

and flushes by construction traffic, settling of the trench, and failure of the seeded and mulched or sodded areas to grow.

G. ACCEPTANCE TESTS FOR MANHOLES

1. Scope of Work. The work shall consist of the furnishing of all labor, equipment, tools, and materials, in the performance of any acceptance test.

   a. All manholes must be tested to assure water tightness.

   b. After the manhole is in place and backfilled to finish grade, then the contractor shall plug the inlet and outlet sewer feeds in a watertight manner. The manhole may then be tested using either a water test or a vacuum test.

2. Water Testing Manholes. The manhole will then be filled with water to the top of the frame (including all adjustment rings). After 24 hours, the water loss will then be measured.

   a. The maximum water loss for any sewer is .455 gpd per foot diameter of manhole per foot height of manhole. This value is to be computed for each individual manhole. The table at the end of this section provides values for the specified manhole segments.

   b. Any manhole that does not meet this acceptance test requirement will be replaced or reconstructed at the contractor's expense. Grouting of interior leaks will not be an acceptable method of reconstruction. The reconstructed manhole will then be tested for acceptance.

3. Vacuum Testing Manholes. The contractor will furnish all facilities required, including necessary piping connections, test pumping equipment, pressure gauges, bulkheads, regulator (to avoid over pressurization) and all miscellaneous items required. Calibration data will be supplied with all pressure test gauges. Certification of vacuum test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed. Test each manhole and accessories after the complete installation. Stabilize the vacuum at 10" Hg (mercury). After temperature has stabilized, the gauge is allowed a maximum of 1" Hg drop during the test period. The required test period is one minute (minimum) for all sizes and manholes depths. If the vacuum test fails to meet the above requirement, repeat test as necessary after all leaks and defects have been repaired.

Manhole Depth (In Feet)		4' diameter Manhole Section Allowable (Sec.)
Greater Than	Less Than - Equal to	
0	4	10
4	6	15
6	8	20
8	10	25
10	12	30
12	14	35
14	16	40
16	18	45
18	20	50
20	22	55
22	24	59
24	26	64
26	28	69
28	30	74

3. No additional payment will be made for acceptance testing.

Section 427.050. Stormwater Systems

A. Pipe

1. Scope of Work. The work shall consist of furnishing all labor, materials, and equipment for the complete installation of storm sewer pipe, and appurtenances, in conformance with the lines and grades shown on the plans or as established by the Engineer and as specified herein. Item of work or materials not specifically mentioned, but necessary for the completion of storm sewer line construction shall be considered as incidental to other items in the contract.

2. Materials.

   a. Pipe. Pipe shall be of the type, size, and class shown on the plans.

      1. Reinforced Concrete Culvert Pipe. Reinforced concrete pipe shall conform to the requirements of the Specifications for Reinforced Concrete Culvert Pipe, A.S.T.M. Designation C76. Unless otherwise shown on the plans or stated in the Special Provisions, installations shall be made with circular pipe conforming to the requirements for Class III, Wall B of this A.S.T.M. specification. When reinforced concrete elliptical pipe is to be used, installation shall be made with pipe conforming to the requirements of A.S.T.M. Designation C507, Class HE-111.

      2. High Density Polyethylene Pipe (HDPE). Corrugated polyethylene pipe shall conform to the requirements of AASHTO M294, "Standard Specifications for Corrugated Polyethylene Pipe". All polyethylene pipes should be installed

according to ASTM D 2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications".

b. Concrete Pipe Joints. Joints for concrete pipe shall be any of the following:

1. Flexible Neoprene Gaskets of the proper size conforming to the requirements of A.S.T.M. Designation C443.

2. Bituminous Mastic Joint Compound. This compound shall be a homogeneous blend of bituminous material, inert filler, and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency.

c. Bedding Material. Material for bedding shall be crushed stone or crushed gravel conforming to the requirements of A.S.T.M. Standard C33, and having a gradation as follows:

	Sieve Size	% Passing
Passing	1/2"	100
Passing	3/8"	0 – 30
Passing	No. 4	0 -5

d. Miscellaneous Materials. Any materials requested for use by the contractor during construction but not described in this specification will be subject to the approval or rejection of the Engineer.

3. Construction Methods.

a. Classification of Excavated Materials. Classification of excavated materials will be made as follows:

1. Rock. Rock is defined as being sandstone, dolomite, chert, granite, siltstone quartzite, slate, shale occurring in its natural undisturbed state, hard and unweathered, in ledges six (6) inches or more in thickness or similar material in masses or boulders, each being more than 1 ½ cubic yards in volume.

Should rock be encountered in two (2) or more ledges, each ledge being more than six (6) inches thick and with interlying strata of earth, clay, shale, or gravel not more than twelve (12) inches thick in each stratum, the entire volume between the top of the upper ledge and bottom of the lower ledge will be classified as rock.

2. Earth. All materials not classified as rock shall be classified as earth. Chert (joint flint rock) broken by intermittent clay partings or clay seams or stratified chert cemented with clay seams (hardpans) shall be classified as earth.

3. Unclassified. Unclassified excavation will consist of the excavation of all materials of whatever character encountered in the work. All material required to be

excavated will be considered as "Unclassified Excavation" unless the contract specifically states otherwise.

b. Excavation. Excavation shall consist of the removal of any and all material below ground level necessary in order to carry out the installation and construction required by the plans and specifications and shall include: (1) Additional excavation required for bedding; (2) All sheeting, shoring, bracing, protection of adjacent property, and underground conduits, or structures, and preparation of the subgrade; (3) The cost of diversion of surface water, pumping, draining, or otherwise dewatering of excavation; and (4) The subsequent handling and disposal of such material not used in the backfill.

Trench excavation shall not be performed any farther ahead of the bedding and pipe laying operations than is necessary to permit a continuous operation. The elevation of the bottom of the trench shall be continually checked for conformance to the lines and grades shown on the plans. Excavation made below proper subgrade elevation shall be backfilled with bedding material and thoroughly compacted at the contractor's expense. Sheeting, timbering, and bracing shall be placed by the contractor whenever necessary for the safety of workmen or the public, and for the preservation of any excavation, embankment, or structure. When the excavation is of such an unstable character or other conditions are such as to render it necessary, the sheeting shall be closely driven and to such depth below the lowest point of the final trench elevation as required for stability. The contractor shall be held responsible for the determination of the need for sheeting or other types of protection and for the sufficiency of all sheeting and bracing used and for all persons injured or property damaged as the result of improper quality, strength, placing, maintaining, or removing the same. No additional compensation will be made for any sheeting, bracing, or other protective measures whether left in place or not.

The contractor shall at his own expense, shore up, protect, and ensure from damage all buildings, retaining walls, viaduct piers and footings, storm sewers, sanitary sewers, gas lines, water lines, fences, curbs, trees, or other property liable to be injured during the progress of the work, and he will be held responsible for all damage which may occur by reason of prosecution of the work.

The contractor shall furnish and operate sufficient pumps and equipment and shall provide all materials, labor, etc., required to prevent interference with the work by water, ice, or snow. Damage of any kind resulting from insufficient pumping facilities or similar lack of protection of the work shall be repaired or replaced by the contractor at his own expense. No water shall be allowed to run into or over any concrete work unless by special permission in writing by the Engineer.

Where leaks or springs are encountered which, in the opinion of the Engineer, affect the safety, usefulness, or satisfactory operation of any of the permanent work, he may direct special precautions to be taken.

The width of the trench at the bottom of the pipe shall provide at least six (6) inches of clear space on each side of the pipe to permit compaction of the bedding material.

The location of storm sewers and structures as shown on the plans have been selected to provide the least possible interference with or the crossing of existing utilities and above-ground obstructions. The City reserves the right to make minor variations in the location of the sewers and structures during the construction to adjust for any changed conditions discovered, and no additional payment will be allowed the contractor for shifts in alignment.

Arrangements shall be made by the contractor with all persons, firms, corporations owning or using any poles, pipes, tracks, or conduits, etc., affected by the construction on this project to maintain and protect such facilities during construction with the cost of any such protection paid by the contractor, and is considered as incidental to other items in the contract.

For requirements relating to the use of explosives, refer to the General Conditions.

Tunneling shall be done only where shown on the plans or by written direction or approval of the Engineer. Tunnels shall be of sufficient size, height, and width to permit proper installation of the pipe, proper bracing of the tunnel section, and to permit ample room for the prosecution of the work and safety of the workmen.

c. Bedding and Pipe Laying. The subgrade of the trench shall be excavated to a depth as to provide space for at least four (4) inches of bedding material between the subgrade and the pipe. Bedding material shall be placed in the trench and carefully graded and compacted to the proper elevation so that the pipe, when placed, shall conform to the specified line and grade. The Engineer will initially provide the contractor with line and grade stakes set on the natural ground surface. It shall be the contractor's responsibility to transfer the line and grade to the bottom of the trench. Three batter boards, a top line, and grade pole or laser beam, shall be used for this purpose or some other method of checking the pipe grade and line approved by the Engineer in writing. The contractor must verify the trench grade or the grade of the top line and storm sewer pipe, and will be held responsible for the correct flow of storm sewers. Any apparent inaccuracy in the grade stakes shall be called to the Engineer's attention immediately upon discovery.

If, in the opinion of the Engineer, subgrade conditions are such that the bedding described above will not adequately support the pipe, he may order the contractor to install concrete cradles.

Storm pipes shall be protected from excessive bearing pressures by placing them outside the forty-five (45°) influence zone of buildings structures unless an engineer's calculations show the pipe material or soil condition to be of adequate strength for the subjected load.

Storm pipes on twenty percent (20%) slopes or greater shall be anchored securely with concrete anchors or their equal to prevent the pipe from creeping downhill. The minimum allowable pipe slope is one-half percent (0.5%).

Storm pipes thirty-six (36) inches or larger in diameter may be placed on a curved alignment utilizing alignment radii established by the pipe manufacturer.

The receiving surface where pipes discharge shall be protected from erosion by evaluating the discharge velocity for the 25-year design storm. The use of energy-dissipating devices may be necessary to reduce the velocity to acceptable levels for the receiving surface. The energy-dissipating device used shall be a minimum length of ten (10) times the diameter of the discharge pipe.

A new drainage channel or pipe shall intersect an existing drainage channel at a maximum angle of sixty degrees (60°).

A manhole, inlet or junction box shall be located at changes in pipe size, grade, alignment or material except for cases where the pipe size is thirty-six inches (36") or greater.

d. Batter Boards and Laser. The contractor shall provide and maintain in good working order, on the site, at all times, a laser beam or a gauge rod of sufficient length to reach from the invert line strung on the three batter boards. The gauge rod shall be graduated and numbered each foot of its entire length. The gauges rod shall be equipped with either a plumb line or tow spirit levels, and the utmost care used to ensure a truly vertical gauge rod at the time the reading is taken and pipe is being set. Each length of pipe shall be laid on an even, firm bed, so that no uneven strain will exist to prevent the pipe from bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each joint as hereinbefore specified. Each pipe shall be in conformity with the line and grade stakes given by the Engineer. Pipe laying shall commence at the low point of the project and progress upgrade, unless otherwise expressly permitted by the Engineer. The bell-end of the pipe shall be laid upgrade. The alignment of all pipelines shall be true to line and grade. The end of each joint of pipe shall be truly centered and fully positioned into the abutting pipe. Pipe laid in the trench shall not be covered until approved by the Engineer.

   In the event a laser beam is used to control line and grade for the pipe laying operation, the laser must be checked at the beginning of each day and at any other time the Engineer deems necessary to ensure the proper line and grade of the pipe.

e. Cleaning. The interior of the storm sewer line shall, as the work progresses, be cleaned of all dirt, excess jointing material, and superfluous materials of every description.

f. Joints. Joints for reinforced concrete pipe with neoprene rubber gaskets shall be made in accordance with manufacturer's recommendations. Bell and spigot, or tongue and

groove ends of the pipe shall first be wiped clean before actual jointing operations are started.

Immediately prior to jointing, all surfaces of the joint shall be thoroughly cleaned and lubricated with soapy water or in accordance with manufacturer's recommendations. The tongue end shall be centered on grade into the groove and of the last downstream length of pipe and shoved completely home and properly seated with the application of steady pressure by a lever, winch, or other suitable device. Care shall be used to prevent displacement of the gasket during jointing.

In sealing concrete pipe with bituminous mastic joint compound, trowel grade compound shall be applied to the mating surfaces of both the tongue and groove, or to the entire interior surface o the bell and the upper portion of the spigot. Two (2) one (1)-inch pieces of rope or tape-type plastic compound shall be applied in accordance with the manufacturer's recommendations. The joints shall be forced together with excess compound extruding both inside and outside the joint. Excess compound shall be removed from the interior surface where accessible. The joint between the bell and spigot shall be uniform for the full circumference and care shall be taken to prevent the bell from supporting the spigot.

g. Backfilling. The backfilling of the trench shall follow closely behind the pipe-laying operation, but not until inspected by the Engineer. In all cases the pipe shall be backfilled the same day as laying.

The backfill material for all storm sewer pipe laid in tunnels shall be sand or finely crushed dolomite of which one hundred (100%) percent shall pass a three-sixteenth (3/16)-inch sieve. It shall be thoroughly compacted.

Backfill Material Under Pavements. This includes all backfill material for storm sewers constructed in open cuts crossing or parallel to roadways, parking lots, driveways, sidewalks, and other existing pavements, or having the trench wall within two (2) feet of the back of street curb or edge of surface. Backfill shall consist of MHTD Type I aggregate in six (6) inch lifts and compacted to ninety-five percent (95%) of the modified proctor maximum dry density. In addition, granular backfill material shall be placed between pipes on all parallel storm sewer pipes located closer than two (2) times the largest pipe diameter. This material shall be placed and thoroughly compacted. Minimum depth for storm sewers on improved streets will be twelve (12) inches plus the pipe depth, and the minimum depth under unimproved streets will be twenty-four (24)-inches plus the pipe depth.

Backfill material not placed under pavements or within two (2) feet of the back of street curb shall be compacted granular material placed half up on all storm sewer pipe. Select material shall be placed from the midpoint of the pipe to one (1) foot above the pipe. Compaction of the select material shall be performed with hand-held tampers to a minimum distance of one (1) foot above the pipe and one (1) foot beyond the sides of the pipe. The backfill material shall be placed in lifts not to exceed twelve

(12) inches in thickness. The backfill shall be placed and compacted on both sides of the pipe simultaneously. Heavier compaction equipment may not be used until the backfill has been placed in a minimum of one (1) foot above the top of pipe, or as directed by the Engineer.

No frozen material shall be used in the backfill. Care shall be taken to avoid injury to the pipe or structures or producing unequal pressures thereon. Earth backfill shall be thoroughly compacted to a density of at least ninety percent (90%) of the maximum density for the material used as determined by ASTM D-698. The top four (4) inches of the backfill shall be made with topsoil and graded as required under Chapter III of these specifications. All surplus excavation material not used in backfilling shall be disposed of by the contractor. Upon receipt of written notice from the Engineer, any settlement of the backfill below the original ground surface shall be remedied by the contractor for a period of six (6) months after final completion and acceptance.

h. Pavement Replacement.

1. Temporary Replacement. If for any reason a roadway must be opened for traffic after the sewer is in place but before the pavement is replaced, then the contractor must provide a one (1)-inch asphalt cap on the trench backfill. This asphalt cap shall be the contractor's responsibility, and no additional compensation will be allowed. Permanent pavement replacement shall not occur any later than thirty (30) calendar days after backfilling unless otherwise approved by the Engineer. Backfill and/or asphalt shall be removed as necessary prior to placement of the permanent pavement.

2. Permanent Replacement. All pavement and curbs damaged during construction, in the opinion of the Engineer, shall be removed and replaced. In order to determine the amount of damage to the pavement and curbs during construction, all existing cracks in the street or curb should be marked in advance of construction. Pavement replacement (whether temporary or permanent) shall closely follow backfilling operation.

   The existing pavement necessary to be removed for construction shall be sawed in a neat line and removed prior to excavation. The width of this removal may be as specified in the special provisions and payment for pavement repair shall not exceed the width specified.

   The paving shall be sawed prior to replacement as to ensure a straight edge and a uniform patch. The subgrade for the new paving shall be further compacted by rolling or tamping. The pavement shall then be relaid carefully in accordance with requirements of the section of the materials specified. The minimum required thickness of pavement replacement shall be either six (6) inches of concrete for concrete surfaces or six (6) inches of concrete and two (2) inches of asphalt surface course for bituminous surfaces.

i. Method of Measurement

1. Pipe. Final measurement of all pipe will be to the nearest foot.

2. Encasement. Final measurement of all encasements will be to the nearest foot.

3. Rock Excavation. Final measurement of rock excavation, if specified, will be to the nearest one-tenth (1/10) cubic yard.

j. Basis of Payment

Contractor will be paid for quantities actually constructed or performed as determined by field measurements at the unit price bid for the items listed in the schedule of the proposal or for such extra work as may be authorized and approved by the Engineer. The cost of incidental work not listed in the schedule of the proposal but necessary for the completion of the project shall be considered as completely covered by bid price for other items in the contract.

Quantities of work acceptably completed under the term of the contract shall be determined by the Engineer based on his actual measurement.

1. Storm sewer pipe in place will be paid for on length of storm sewer laid from inside edge of structure to inside edge of structure and shall include the cost of all labor, materials, including joints, and other necessary fittings, excavation, backfill, and equipment.

2. Rock Excavation, if specified, will be calculated at a width of three (3) feet for pipe up to and including twenty-four (24) inches in diameter. For pipe having a diameter greater than twenty- four (24) inches, the trench width to be paid for will be calculated as the pipe width plus six (6) inches on each side of the pipe.

B. Concrete Structures

1. Scope of Work.

The work shall consist of furnishing all labor, materials, and equipment necessary to perform all operations in connection with the construction of junction boxes, inlets, manholes, concrete culverts, headwalls and catch basins required for the project in accordance with the specifications and drawings. Items not specifically mentioned, but necessary for completion of the work shall be considered as incidental to other items in the contract.

2. Materials.

a. Concrete shall be Class "A" Portland Cement Concrete in accordance with the requirements of Chapter IX of these specifications.

b. Reinforcing steel shall consist of deformed bars of grade 40 steel conforming to the requirements of A.S.T.M. designation A615 or of wire fabric conforming to A.S.T.M. designation A185.

c. Expansion Joint Fillers shall be of a non- extruding type conforming to A.S.T.M. designation D1751 and cut to the dimensions shown on the plans.

d. Precast units may be substituted provided they meet plan intent.

e. Manhole and inlet castings located in travelways shall be capable of withstanding traffic loads and shall be constructed flush with the finished surface.

3. Construction Methods.

a. Forms. Forms shall be of wood, plywood, or any other suitable material, designed, constructed, braced, and maintained so that the finished concrete will be true to line and elevation and will conform to the required dimensions. They shall be designed to withstand the pressure of the concrete; the effect of vibration as the concrete is placed in all other loads incidental to the construction operations without distortion or displacement. They shall be mortar tight. Oiling both inside and outside surfaces will be required to prevent warping, shrinkage or swelling.

Forms shall be constructed and designed so that their removal can be effected without injury to the concrete, and so that portions where surface finishing is required may be removed without disturbing forms that are to remain. Dirt, chips, sawdust, nails, and other foreign matter shall be removed before any concrete is deposited therein.

Tie rods, belts, and anchorages within the forms shall be constructed so as to permit their removal to a depth of at least one and one-half (1 ½)-inches from the face without injury to the concrete. In case wire ties are used, upon removal of the forms, all projecting wire shall be cut back at least one-half (1/2) inch from the face of all surfaces that will be exposed to view after completion of the work and flush with the face of all concrete surfaces that will not be exposed to view. All fittings for metal ties shall be of such design that, upon their removal, the cavities, which are left, will be of the smallest practical size.

b. Inlet and Outlet Pipe. Pipe or tile placed in the concrete for inlet or outlet connections shall extend through the concrete walls beyond the outside surfaces of the walls a sufficient distance to allow for connections. The pipe or tile shall be placed through the forms and poured in place.

The ends of the pipe shall be flush with the inside wall of the structure.

The angle between influent and effluent pipes shall be not less than ninety degrees (90°), and the drop between inverts shall be not less than one-tenth (0.1) foot.

c. Bedding. The subgrade for the structure shall be excavated a sufficient depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the structure. Bedding material shall be placed and compacted to the proper elevation. If rock is encountered within six (6) inches of the bottom of the structure, then excavate down a minimum of six (6) inches and backfill with bedding material.

4. Reinforcement.

a. Placement. Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with Concrete Reinforcing Steel Institute "Recommended Practice for Placing Reinforcing Bars," and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the surface of the concrete (except where shown on the plans) and wooden supports, shall not be used.

Placing bars in layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rust, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved.

b. Splicing. Splices of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least thirty (30) diameters, unless otherwise shown on the plans.

Splicing shall be accomplished by placing the bars in contact with each other and wiring them together.

Welding of reinforcing steel or cutting with a cutting torch will not be permitted unless specifically authorized by the Engineer.

c. Bending Reinforcement. Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the American Concrete Institute.

Bars shall not be bent or straightened in a manner which will injure the material. Bars with kinks or unspecified bends shall not be used.

d. Welded Wire Fabric. Welded wire fabric shall be spliced not less than two (2) meshes. It shall be lifted carefully into its specified position after the concrete is placed but still plastic.

5. Placing Concrete. Concrete shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients.

Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.

Where a sequence for placing concrete is shown on the plans, no deviation will be permitted unless approved in writing by the Engineer.

Where concrete is to be deposited against hardened concrete at horizontal construction joints, placing operations shall begin by conveying a grout mixture through the placing system and equipment, and depositing the mixture on a joint. The grout mixture shall consist of a modification of the concrete specified to reduce the quantity of coarse aggregate in the mix larger than pea-gravel size to one-half (1/2) the quantity specified.

To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened or is contaminated by foreign materials shall not be deposited in the structure.

Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and proceed upgrade unless otherwise permitted by the Engineer. Concrete shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.

Concrete shall not be permitted to fall more than six (6) feet without the use of pipes or tremies. Pipes or tremies shall be at least six (6) inches in diameter, or the equivalent cross sectional area for rectangular sections. Concrete shall not be placed in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a two (2)-hour period has elapsed to permit shrinkage to occur.

Concrete shall be thoroughly vibrated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Structural concrete, except slope paving steeper than one (1) inch per foot, such as spillway aprons and channel lining, and concrete placed under water, shall be consolidated by means of high-frequency, internal vibrators of a type, size, and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and course aggregate, and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in

good operating condition shall be available at the site of the structure in which more than twenty- five (25) cubic yards of concrete is to be placed.

6. Joints. The work shall be so prosecuted that construction joints will occur at designated places shown on the plans unless otherwise authorized by the Engineer. The contractor shall construct, in one continuous concrete placing operation, all work comprised between such joints. Joints shall be kept moist until adjacent concrete is placed.

   All construction joints having a keyed, stepped, or roughened surface shall be cleaned prior to placement of the adjacent concrete as directed by the Engineer.

   Expansion and contraction joints in concrete structures shall be formed where shown on the plans. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

   No direct payment will be made for furnishing and placing asphaltic paint, premolded asphaltic filler, or other types of joint separators. The cost therefore shall be included in the price bid for the item of work of which they are a part.

7. Cold Weather Requirements. Whenever the temperature of the surrounding air is below 40 degrees F or when the possibility exists that the temperature will fall below 40 degrees F, within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature of between 80 degrees F and 100 degrees F. All concrete shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing, shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations.

8. Finishing. The top surfaces of structures shall be struck off with a straight edge and finished with a wood float. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with plastic sheet, burlap, or sprayed with white pigmented membrane curing compound conforming with A.S.T.M. designation 309, Type 2. Forms shall be removed between twelve (12) and twenty-four (24) hours after concrete placement and all exterior form ties shall be removed to a depth of one (1) inch below the surface, all fins caused by forms, joints, and other projections, shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

9. Inverts. Inverts for inlet boxes, junction boxes, and other drainage structures shall be constructed with cement mortar after other concrete work has been done. Inverts shall be smoothly finished in accordance with the plans and to ensure a smooth flow of water through the structure.

10. Backfilling. Structures which lie within the area to be paved, or within two (2) feet of the back of curb, such as curb inlets or junction boxes, shall be backfilled with granular material meeting the requirements of bedding material specified hereinbefore. Backfill not within two (2) feet of the paving area may be clean earth. Bedding material shall be placed and thoroughly compacted. Earth backfill shall be placed in accordance with the requirements specified hereinbefore for pipe backfilling.

11. Removal of Forms. Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather, and other conditions influencing the setting of the concrete and the requirements for curing and finishing.

12. All exposed metal shall be painted and primed in accordance with the Standard Drawings.

13. Castings. Manhole and inlet castings located in travelways shall be capable of withstanding traffic loads and shall be constructed flush with the finished surface.

14. Manholes. Manholes shall be pre-cast or cast-in-place concrete with concrete risers and approved manhole covers.

15. Grated Inlets. Grated inlets will not be allowed without special approval by the Administrative Office or their representative.

16. Basis of Payment. Inlets, junction boxes, manholes and catch basins include all labor, equipment, materials, excavation backfill, forms, reinforcement, and frame and grate, or ring and lid, as per plan or standard, to complete the structure in place as per the location called for on the plans. These structures shall be paid for at the base price for each structure complete in place.

    a. Culverts, headwalls and other concrete structures specified herein specified will be paid for at base price per cubic yard of concrete as per plan dimensions and will include all labor, equipment, materials, excavation, backfill, forms, reinforcement, except castings, as per drawings and specifications to complete the structure in place.

    b. Special castings used in these structures will be paid for as provided in the contract documents or special provisions.

C. Manhole Adjustment

1. Scope of Work. The work shall consist of the adjustment of storm sewer manhole frames and structures within the construction area to the lines and grades shown on the plans or as established by the Engineer.

2. Materials. The following materials may be used in adjusting the grade of the manhole tops:

   a. Precast Reinforced Concrete (Adjustment Rings)

   b. Manhole sections per ASTM C478

   c. Preformed Flexible Joint Material per AASHTO designation M-198

3. Construction Methods. The grade of a manhole may be raised a maximum of one (1) foot by removing the frame and building up with precast concrete adjustment rings. The frame shall be reset in preformed flexible joint material. Where required to raise the grade of a manhole more than one (1) foot, the contractor shall be required to remove the cone section of the manhole, add a barrel section approximately the height of the grade change, and replace the cone section and necessary adjustment rings, etc. as directed by the Engineer.

   Where it is required to lower the grade, (unless there is a sufficient height of precast concrete adjustment rings in place above the cone section which can be removed) the cone section and a sufficient number of barrel sections shall be removed and the cone section replaced or changed as directed by the Engineer. Reconstruction of the manhole shall be in accordance with applicable requirements of Sanitary Sewer Construction in Chapter VI, paragraph B of these Specifications.

   The existing manhole ring and lid shall be removed and placed in a location designated by the Inspector and become the property of the City. A new standard manhole Type A ring and lid shall be installed on the manhole as a part of the adjustment.

4. Basis of Payment. Manhole adjustments for storm sewer manhole frames and covers shall be paid for at the contract unit price of each structure. This shall include all labor, equipment, material, including new ring and lid, and excavation, to complete the adjustments to the lines and grades shown on the plans or as established by the Engineer.

D. Flared End Sections

1. Scope of Work. This work shall consist of furnishing and installing precast concrete or Corrugated High Density Polyethylene (HDPE) flared end sections of the size and shape shown on the plans.

   a. Precast cast flared end sections shall be used with concrete or vitrified clay culvert pipe.

   b. Corrugated HDPE flared end sections shall be used with HDPE pipe up to thirty-six (36) inches in diameter.

2. Material.

a. Concrete shall be Class "A" Portland Cement Concrete in accordance with the requirements of Chapter IX of these specifications.

b. Corrugated HDPE flared end sections shall be high density polyethylene meeting ASTM D3350-000 with a minimum cell classification of 213320C. Each end section shall have a carbon black additive for UV protection.

3. Construction Methods. Flared end sections shall be joined to pipes or pipe-arches as shown on the plans and shall be placed to the line and grade of the structure on a uniformly firm soil foundation shaped to fit the lower part of the end section.

   a. Precast Concrete Flared End Sections. The joint material between the end section and the adjoining pipe shall be the same as that used for pipe joints, and shall be installed in the same manner. Toe walls shall be the size and shape shown on the plans and may be precast or cast-in-place. Forming of cast-in-place tow walls will not be required.

   b. Corrugated HDPE Flared End Sections. The end section shall be joined to the pipe section using the manufacture's recommended fasteners. The end section shall be at the same elevation as the invert of the adjoining pipe.

4. Method of Measurement. Measurement of precast concrete or plastic flared end sections will be made per each.

5. The accepted quantity of flared end sections, complete in place, will be paid for at the contract unit price for each of the items included in the contract. No direct payment will be made for any excavation or bedding required for placement of an end section or toe walls. Any damaged sections required to be replaced due to the contractor's actions shall be at the contractor's expense.

E. Acceptance of Detention on Private Improvements

The construction of the detention facilities must be approved by the Public Works Department prior to the issuance of a Certificate of Occupancy.

F. Field Tests and Inspections

The contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work performed is in accordance with the requirements and intent of the plans and specifications. Any work done (except excavation) or material used without suitable supervision or inspection by the Engineer may be ordered removed and replaced at the contractor's expense. Corrugated metal pipe installations will not be accepted if deformation of pipe exceeds five (5) percent of the diameter in any direction.

Section 427.060. Streets and Roadways

These specifications shall apply to the construction of streets and roadways in the City of Farmington. In addition to the requirements listed herein, the work shall meet the criteria established in the City of Farmington's Design Standards for Public Improvements.

A. Base Rock

1. Scope of Work.

This work shall consist of furnishing and placing select rock material in the top twelve (12) to eighteen (18) inches of the subgrade for use as a stabilizing base to provide pavement support and drainage as shown on the plans or directed by the Engineer.

2. Materials.

a. The material source for rock base shall be in accordance with approval from the Engineer.

b. Material for rock base shall be durable stone or broken concrete containing a combined total of no more than ten (10) percent, by weight, of earth, sand shale and non-durable rock.

c. The material shall be as large as can be conveniently handled with the limits of this specification. No particle dimension shall exceed approximately twelve (12) inches for eighteen (18) inch rock base or nine (9) inches for twelve (12) rock base.

d. Broken, sound concrete pavement and composite pavements may be used provided the ratio of the longest dimension measurement to thickness does not exceed 2:1 and provided there is no excessive exterior steel mesh that would affect compaction. Milled, crushed or chunked forms of bituminous pavement shall not be used. Small, thin amounts adhering to broken concrete pavement will be permitted.

e. Acceptance of quality and size of material will be made by visual inspection at the job site by the Engineer.

3. Construction Methods.

a. The material shall not be dumped in place, but shall be distributed by blading or dozing in a manner to ensure proper placement in final position in the subgrade.

b. Material for either twelve (12) inch or eighteen (18) inch rock base may be placed in one lift. Rock base material may be placed thicker, with the approval from the City, in maximum 24-inch lifts, provided a uniform drainage plane under the rock base is provided. No particle dimension shall exceed approximately 6 inches less than the placed lift thickness. There shall be some material with particle dimension exceeding

approximately fifty (50) percent of the lift thickness. No additional payment will be made for the thicker rock base material.

c. The final surface shall be of a uniform texture and grade suitable for paving. The top two (2) inches of rock base shall consist of either two (2) inch maximum rock fragments, spalls, reclaimed asphalt, or concrete. The two (2) inch maximum size granular material shall have a plasticity index not to exceed 10 and a gradation such that at least fifty (50) percent of the material will be retained on the No. 4 sieve or have a gradation meeting Type 5 aggregate.

4. Basis of Payment.

a. Payment for placing rock base will be made at the contract unit price per square yard complete in place, based entirely on the surface area of the design thickness. No additional payment will be made for material needed to maintain the required edge slopes.

B. Aggregate Base Course

1. Scope of Work. This work shall consist of furnishing and placing one of more courses of aggregate on a prepared subgrade in accordance with these specifications, and as shown on the plans or directed by the City.

2. Materials. Material for Type 1 and Type 5 aggregate bases shall be crushed stone or reclaimed asphalt or concrete which meet the requirements stated in Section B, paragraph 4 & 5 respectively.

3. Construction Requirements. All work on that portion of subgrade on which the base is to be constructed shall be completed in accordance with Chapter III prior to placing any base material on that portion. Aggregate base shall not be placed on frozen subgrade.

4. Construction Methods. The contractor shall place base material on the roadbed as shown in the contract documents. The maximum compacted thickness of any one layer shall not exceed six (6) inches. If the specified compacted depth of the base course exceeds six (6) inches, the base shall be constructed in two or more layers of approximately equal thickness

5. Shaping and Compacting. Each layer shall be compacted to the specified density as stated in the contract. If no specifications are given then the following shall apply:

a. Type 1 and Type 5 aggregate base located under any portion of roadway shall be compacted to a minimum of ninety-five (95) percent of the standard maximum density.

b. Standard Compaction Test will be conducted in accordance with AASHTO T 99, Method C.

c. If at any time the compacted aggregate subgrade becomes unstable, the contractor, at the contractor's expense, shall restore the earth subgrade and the aggregate base to the required grade, cross section and density.

6. Maintenance. The contractor shall maintain, at the contractor's expense, the required density and surface condition of any portion of the completed aggregate base until either the prime coat or a succeeding course of pavement is placed. If a prime coat is specified in the contract the contractor shall apply the prime coat on any completed portion of the aggregate base as soon as practical, or as otherwise specified.

7. Basis of Payment. The accepted quantities of aggregate base course of the thickness and type specified will be paid for that contract unit price of each of the pay item included in the contract. Payment will be considered full compensation for water used in performing this work.

C. Flexible Pavements

1. Bituminous Base Course.

a. Scope of Work. The work shall include all labor, equipment, and materials necessary for the furnishing, mixing, hauling, placing, and consolidation of plant mix bituminous base course in accordance with the plans and contract documents.

b. Materials.

1. Asphalt Cement. This material shall be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for penetration grade 85-100. Material from any one source for any one source for any one contract shall not vary more than 0.02 in specific gravity.

Asphalt Cement Table		
	85 – 100	
Penetration Grade	Min.	Max.
Penetration at 25C (77F) 100g, 5 sec.	85	100
Flash point, (Cleveland open cup), degrees C	232	---
(F)	(450)	
Ductility, 5 cm/min, 25 C (77F), cm	100	---
Solubility in trichloroethylene, percent	99.0	---
Spot test-Standard Naphtha (Note 1)	Negative	
Thin-film oven test 1/8 in., 163 C (325F), 5 hour; Loss on heating percent	---	1.0
Penetration of residue, percent of original	50	---
Ductility of residue, 5 cm/min 25 C (77F), cm	75	---

Note 1 – The spot test shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, "If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated." Delete Section 5.3 through 7.3, inclusive.

2. Fine Aggregate. Fine aggregate for bituminous base course shall be a fine, granular material naturally produced by the disintegration of rock of a siliceous nature. With written approval of the Engineer, chat sand produced from flint chat in the Joplin area, or fines manufactured from crushed dolomite, igneous rock and chert gravel, or wet bottom boiler slag may be used as fine aggregate for asphaltic concrete. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating or injurious material. The percentage of deleterious substances shall not exceed the following values:

Item	Percent by Weight
Clay lumps or shale	1.0
Total lightweight particles, including coal or lignite	0.5
Other deleterious substances	0.1

Lightweight sand particles are not considered deleterious lightweight particles. The total lightweight particles requirement shall not apply to wet bottom boiler slag, angular chert sand, or manufactured sand.

3. Mineral Filler. Mineral filler shall consist of dolomite dust, Portland cement, or other suitable mineral matter. It shall be thoroughly dry and free of lumps consisting of aggregations of fine particles. When tested in accordance with AASHTO T37 the mineral filler shall conform to the following gradation requirements.

	Percent
Passing No. 30 sieve	100
Passing No. 50 sieve	95 – 100
Passing No. 100 sieve	90 – 100
Passing No. 200 sieve	70 - 100

4. Graded Aggregate. Graded aggregate for bituminous base shall consist of sound, durable rock particles, free from objectionable coatings. When tested in accordance with AASHTO T 96, the percentage of wear shall not exceed 55. The percentage of deleterious substances shall not exceed the following values and the sum or percentages of all deleterious substances shall not exceed eight (8) percent.

	Percent Passing by Weight
Deleterious Rock	8.0
Mud Balls and Shale combined	2.0
Clay, uniformly dispersed	3.0
Other foreign material	0.5

The gradation of the course aggregate shall be such that the total aggregate meets the gradation requirements specified hereafter in Paragraph three (3) prior to being fed into the cold aggregate feeders.

5. Type I Aggregate shall conform to the following requirements:

Type I aggregate shall be essentially crushed stone, sand and gravel. It shall not contain more than fifteen (15) percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements:

	Percent
Passing one (1) inch sieve	100
Passing one-half (1/2) inch sieve	60 – 90
Passing No. 4 sieve	40 – 60
Passing No. 30 sieve	15 - 35

The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six (6).

6. Type 5 Aggregate shall conform to the following requirements:

Type 5 aggregate shall be essentially crushed stone, sand and gravel. It shall not contain more than fifteen (15) percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements:

	Percent
Passing one (1) inch sieve	100
Passing one-half (1/2) inch sieve	60 – 90
Passing No. 4 sieve	40 – 60
Passing No. 30 sieve	15 - 35
Passing No. 200	0 - 15

7. Material. The asphalt cement material used for prime coat shall be Type MC, grade MC- 30, and be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for the penetration or viscosity grade specified herein. Material from any one source for any one contract shall not vary more than 0.02 in specific gravity.

Type MC Liquid Asphalt		
	MC – 30	
Grade	Min	Max
Water, percent	--	0.2
Flash point (Tag open cup), degrees C	38	--
(F)	(100)	--
Kinematic Viscosity at 60C (140 F), centistokes	30	60
Distillation test: Distillate, percentage by volume of total distillate		
To 360 C (680 F)		
To 225 C (437 F)	--	25
To 260 C (500 F)	40	70
To 315 C (600 F)	76	93
Residue from distillation to 360 C (680 F) volume percentage of sample by difference	50	--
Tests on residue from distillation: Penetration, 100 g. 5 sec., at 25 C (77 F)	120	250
Ductility, 5 cm/min., cm (Note 1)	100	--
Solubility in trichloroethylene, percent	99.0	--
Spot test-Standard Naphtha (note 2)	Negative	

Note1– If the ductility at 25C *77F) is less than 100 cm, the material will be acceptable if its ductility at 15.6 (60F) is more than 100 cm.

Note 2 – The spot tests shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, "If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated."

c. Composition of Mixtures.

1. Aggregate composition. The bituminous base shall be composed of a mixture of crushed dolomite or dolomite, except as hereinafter permitted, filler if needed, and asphalt cement. The aggregate prior to mixing with asphalt cement shall meet the following gradation requirements:

	Percent by Weight
Passing 1-inch sieve	100
Passing ½-inch sieve	60 – 90
Passing No. 4 sieve	35 – 65
Passing No. 10 sieve	25 – 45
Passing No. 40 sieve	10 – 30
Passing No. 200 sieve	5 - 12

At the option of the contractor, fine aggregate having 100-percent passing the three eighths (3/8)-inch sieve and not more than six (6) percent passing the No. 200 sieve may be incorporated into the mixture. The total quantity of such fine aggregate shall not exceed thirty (30) percent by weight of the combined aggregate.

The composition of the mixture shall be as directed by the Engineer and shall conform to the following limits by weight.

	Percent
Total Mineral Aggregate	94 – 97
Asphalt Cement	3 – 6

2. Job-mix formula. Prior to preparing any of the mixture on the project, the contractor shall submit for the Engineer's approval, a job-mix formula for the mixture to be supplied for the project. No mixture will be accepted for use until the job-mix formula for the project is approved by the Engineer. The job-mix formula shall be within the gradation range specified for bituminous base and shall include the type and sources of all materials, the gradations of the aggregates, and the relative quantity of each ingredient, if more than one, and shall state a definite percentage for each fraction of aggregate. No job-mix formula will be approved which does not permit within the limits specified in Paragraph 3 herein the full tolerances specified; Paragraph 3c herein for asphalt cement and not less than one-half (1/2) the tolerances specified in Paragraph 3d herein for material passing the No. 10 sieve and the material passing the No. 200 sieve. The job-mix formula approved for the mixture shall be in effect until modified in writing by the Engineer. When unsatisfactory results or other conditions make it necessary, or should a source of material be changed, a new job-mix formula may be required.

3. Changes in proportions. The Engineer will make such changes in the proportions of asphalt cement and aggregates as he considers necessary within the limits of the specifications. The proposed mixture will be compacted and tested in the laboratory in accordance with AASHTO T 167 and the bulk specific gravity will be determined in accordance with the procedures described in AASHTO T 165. The mixture of mineral aggregate and asphalt cement shall result in a bituminous mixture, which will be durable and retain satisfactory cohesion and stability in the presence of moisture. Chemical additions approved in writing by the Engineer may be made to the asphalt, cement, or to the mixture.

4. Gradation control. In producing mixtures for the project, the plant shall be so operated that no intentional deviations from the job-mix formula are made. Mixtures as produced shall be subject to the following tolerances and controls:

5. Total aggregate gradation shall be within the master range specified in Paragraph 3a, herein.

6. Maximum variations from the approved job-mix formula shall be within the following tolerances:

a.	Passing No. 10 sieve	+/-5.0% points
b.	Passing No. 200 sieve	+/-2.0% points

7. Quantity of asphalt cement introduced into the mixer shall be that quantity specified in the job-mix formula. No change may be made in the quantity of asphalt cement specified in the job-mix formula without written approval of the Engineer. The quantity of asphalt cement determined by calculation or tests on the final mixture shall not vary more than +/- 0.5 percentage points from the job-mix formula.

8. Commercial Mixture. The contractor may, at his option, use an approved commercial mixture. The contractor shall, at least seven (7) days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture he proposes to furnish. The statement shall include (1) the types and sources of aggregates, percentage range of each, and range of combined gradation; (2) the percent and grade of asphalt; and (3) the mixing time and range of mixture temperature. The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. If the proposed mixture is approved by the Engineer, the component materials and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall, with each truck load, furnish a certification in triplicate that the materials and mixture delivered are in conformance with this approved proposal. The mixture shall be transported, placed, and compacted in accordance with the requirements specified hereinafter.

d. Construction Requirements.

1. Weather Limitations. Bituminous mixtures shall not be placed (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 35 degrees F and falling, (2) on any wet or frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.

2. Subgrade Preparation. The subgrade shall be prepared in accordance with the requirements of Section III of these Specifications.

3. Aggregate Base. Type 1 Aggregate Base shall be placed under all bituminous pavements and shall extend 1'-0" beyond the back of curbs. Refer to Table VII-1 in the "Design Standards for Public Improvements" for required thicknesses. The

aggregate material shall be compacted to not less than one hundred percent (100%) of Standard maximum density. Moisture shall be added to the material during compaction only when it is necessary to obtain the required density. Measurement for payment of the aggregate shall be by truck ticket or computed to the lines and grades of the aggregate on plans and weighing 116 pounds per square yard per inch of thickness plus five percent (5%) for moisture, whichever is smaller. All extra aggregate used under pavements shall be the contractor's responsibility.

4. Application of Prime Coat. A bituminous prime coat shall be applied to all Aggregate Base courses to which bituminous material shall be applied when the asphalt thickness is less than five (5) inches. The prime coat shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. The application rate shall be .35 gallon per square yard. The primer shall be heated at the time of application to a temperature specified in the table below.

Application Temperature for Bituminous Materials

Bituminous Mat.	Temperature, Degrees Fahrenheit			
	Spraying		Mixing	
Liquid Asph MC Grade 30	Min.	Max.	Min.	Max.
	70	150	50	110

Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified quantity. Building paper shall be placed over the end of the previous applications and the joining application shall start on the building paper. Building paper used shall be removed and satisfactorily disposed of. Pools of primer material remaining on the surface after the application shall be removed.

When traffic is maintained, not more than one half of the width of the section shall be treated in one application and one-way traffic will be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be routed to the treated portion and the remaining width of the section shall be primed.

If, after the application of the prime coat, the bituminous material fails to penetrate, and the roadbed must be used by traffic, sand blotter material shall be spread in the quantity required to absorb any excess bituminous material.

The primer shall be properly cured, and the primed surface shall be cleaned of all dirt and surplus sand before the next course is placed.

5. Transportation. The prepared base course mixture shall be transported from the paving plant to the work in tight vehicles previously cleaned of all foreign materials. The inside of truck beds shall be lubricated with a thin oil to prevent the mixture from adhering to the bed, but an excess of lubricant will not be permitted. Each load shall be covered with canvas or other suitable material of sufficient size to protect it from the weather. No loads shall be sent out so late in the day that spreading and compacting of the mixture cannot be done during daylight.

6. Spreading. The base course, primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil, or any other foreign material prior to spreading the bituminous mixture. When delivered to the roadbed, the mixture shall be at a temperature, which will permit proper placement and compaction. It shall be spread with an approved spreading and finishing machine in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. The compacted thickness of a single layer shall not exceed three (3) inches except the uppermost layer directly under the surface course for travel ways and auxiliary lanes shall be placed in a single layer not to exceed the width and thickness shown on the plans. In widening construction the material may be placed in two layers, provided the thickest layer is placed first and no individual layer has a compacted thickness greater than three (3) inches. On base widening work, a succeeding layer of bituminous mixture may be placed the same day as the previous layer, if it can be shown that the desired results are being obtained. On small areas, and on areas which are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods if permitted by the Engineer.

   The mixture shall be spread without tearing the surface and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with suitable mixture. The outside edges of the base shall be constructed to an angle of approximately 45 degrees with the surface of the roadbed. The outside edge alignment shall be uniform and any irregularities shall be corrected by adding or removing mixture before compacting.

   If required by the contract, a leveling course consisting of a layer of variable thickness shall be spread to the desired grade and cross section to eliminate irregularities in the existing surface. Spot-leveling operations over small areas, with featheredging at high points and ends of spot areas, may be required prior to placing the leveling course. Rigid control of the placement thickness of the leveling course will be required. The use of an approved finishing machine will be required on the spot leveling and the leveling course, except that the spreading of the spot-leveling with a blade grader will be permitted if results indicate the mixture is practically free from segregation.

7. Joints. Longitudinal and transverse joints shall be carefully made and well bonded. Transverse joints shall be formed by cutting back on the previous run so as to expose the full depth of the layer. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately six (6) inches.

8. Compaction. Rolling shall include the use of a vibratory steel wheel roller. Rolling shall begin as soon after spreading the mixture as it will bear the weight of the roller without undue displacement. All rollers shall be in satisfactory condition capable of reversing without backlash, and steel wheel rollers shall be equipped with scrapers. Rollers shall have a system for moistening each roll or wheel. A trench roller shall be used on depressed areas inaccessible to regular width equipment. The compacted mixture shall have a density of not less than ninety-five (95%) percent of standard proctor. Density will be determined by the direct transmission nuclear method.

   In lieu of roller and density requirements, mixtures used for shoulders adjacent to rigid pavement, shoulders adjacent to resurfaced rigid pavement, temporary bypasses to be maintained at the expense of the contractor, and areas where a commercial mixture is used shall be thoroughly compacted by at least three complete coverages over the entire area with a tandem-type vibratory steel wheel roller weighing not less than ten (10) tons. Final rolling shall be done with the tandem-type steel wheel roller. Rolling shall be performed at proper time intervals on each layer and shall be continued until there is no visible evidence of further consolidation.

9. Surface Tolerance. The finished layers shall be substantially free from waves or irregularities and shall be true to the established crown and grade. At transverse construction joints the surface of all layers shall not vary from a ten (10)-foot straightedge, applied parallel to the centerline, by more than one-fourth (1/4) inch, except that the entire surface of the final layer of plant mix bituminous base mixture shall not vary from the ten (10)-foot straightedge by more than one-eighth (1/8) inch if this layer is used as the final riding surface course. Areas exceeding this tolerance shall be rerolled, replaced, or otherwise corrected in a manner satisfactory to the Engineer.

10. Tolerance in Pavement Thickness. It is the intent of these specifications that the plant mix bituminous base course shall be constructed strictly in accordance with the thickness shown on the plans. The total thickness of the pavement will be measured by coring. Where any pavement is found deficient in thickness, corrective actions shall be taken as indicated in this Chapter.

    No additional compensation will be allowed the contractor for any plant mix bituminous base course constructed in excess of the thickness requirements of the plans and specifications. The surface from which the cores have been taken shall be restored by the contractor within forty eight (48) hours using a mixture acceptable to the Engineer.

e. Method of Measurement. Full depth pavement areas of plant mix bituminous base course will be measured to the nearest one tenth (1/10) square yard. Areas requiring a variable thickness bituminous base course will be measured on a per ton basis. The weight of the bituminous base course for the areas requiring a variable thickness will be determined from weight tickets for each truck delivering base course to the job site. Final measurement for variable thickness base course will be to the nearest one tenth (1/10) ton of acceptable base course.

f. Basis of Payment. Payment for all plant mix bituminous base course shall include all labor, materials, and equipment necessary for the construction of the bituminous base course in place. Prime coat will be considered incidental to said construction unless specified separately in the specifications.

Payment for full depth pavement areas of plant mix bituminous base course will be on a square yard basis. Payment for variable thickness bituminous base course will be on a per ton basis. In case a truck load of bituminous base course is to be spread in both areas of full depth pavement and variable depth pavement, the contractor and Engineer shall agree on the tonnage of that portion of the load used in the variable depth area, prior to its placement. The conversion from tons to square yards is based on 110 lbs./sq. yd/inch.

2. Bituminous Surface Course

a. Scope of Work. The work shall include all labor, equipment, and materials necessary for the furnishing, mixing, hauling, placing, and consolidation of plant mix bituminous base course in accordance with the plans and contract documents.

b. Materials.

1. Asphalt Cement. This material shall be homogenous and free from water, and shall not, on heating, foam below the specified minimum flash point. It shall be prepared by refining crude petroleum by suitable methods. It shall conform to the requirements of the following table for penetration grade 85-100. Material from any one source for any one contract shall not vary more than 0.02 in specific gravity.

	85 – 100	
Penetration Grade	Min.	Max.
Penetration at 25C (77F) 100g, 5 sec	85	100
Flash point, (Cleveland open cut), degrees C	232	---
(F)	(450)	---
Ductility, 5 cm/min, 25C (77F), cm percent	100	---
Solubility in trichloroethylene, percent	99.0	---
Spot test-Standard Naphtha (Note 1)	Negative	
Thin-film oven test 1/8 in., 163 C (325 F), 5 hour; Loss on heating percent	---	1.0
Penetration of residue, percent of original	50	---
Ductility of residue, 5 cm/min 25C (77F), cm	75	---

Note 1 – The spot test shall be conducted in accordance with AASHTO T 102, with the following modifications: Add to Section 5.2.1, "If, however, the drop forms a uniformly brown circular stain, the test shall be reported as negative. In case of dispute, the entire test shall be repeated." Delete Section 5.3 through 7.3, inclusive.

2. Coarse Aggregate. All course aggregate shall consist of sound, durable rock, free from cemented lumps or objectionable coatings. When tested in accordance with AASHTO T96, the percentage of wear shall not exceed 50. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances shall not exceed eight (8) percent.

	Percent by Weight
Deleterious Rock	8.0
Shale	1.0
Other Foreign Material	0.1

The requirements of this section apply to each size or fraction of aggregate produced.

If a density requirement is specified for plant mix bituminous surface course the total quantity of chert in each size or fraction of produced crushed stone aggregate, including that permitted as deleterious, shall not vary more than ten (10) percentage points from the quantity present in the aggregates used in the approved laboratory job mixtures.

Gravel aggregate shall be washed sufficiently to remove any objectionable coating.

3. Fine Aggregate. Fine aggregate for plant mix bituminous base course shall be a fine, granular material naturally produced by the disintegration of rock of a siliceous nature. With written approval of the Engineer, chat sand produced from flint chat in the Joplin area, or fines manufactured from crushed dolomite, igneous rock and chert gravel, or wet bottom boiler slag may be used as fine aggregate for asphaltic concrete. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating or injurious material. The percentage of deleterious substances shall not exceed the following values:

Item	Percent by Weight
Clay lumps or shale	1.0
Total lightweight particles, including coal or lignite	0.5
Other deleterious substances	0.1

Lightweight sand particles are not considered deleterious lightweight particles. The total lightweight particles requirement shall not apply to wet bottom boiler slag, angular chert sand, or manufactured sand.

4. Mineral Filler. Mineral filler shall consist of dolomite dust, Portland cement, or other suitable mineral matter. It shall be thoroughly dry and free of lumps consisting of aggregations of fine particles. When tested in accordance with AASHTO T37 the mineral filler shall conform to the following gradation requirements.

	Percent
Passing No. 30 sieve	100
Passing No. 50 sieve	95 – 100
Passing No. 100 sieve	90 – 100
Passing No. 200 sieve	70 – 100

c. Composition of Mixtures.

1. Gradation of Combined Aggregates. The total aggregate prior to mixing with asphalt cement shall meet the following requirements for Grade D mixture:

GRADE D	
Gradation	Percent Passing By Weight
Passing ¾ – inch sieve	100
Passing ½-inch sieve	95 – 100
Passing No. 4 sieve	60 – 90
Passing No. 10 sieve	35 – 65
Passing No. 40 sieve	10 – 30
Passing No. 200 sieve	4 – 12

2. The combinations of materials required in this section shall meet the gradation requirements specified for the work.

Not less than fifteen (15) percent or more than thirty (30) percent natural siliceous sand, porphyry sand, manufactured sand or flint sand of approved quality shall be added as a separate ingredient. Sand shall have one hundred (100%) percent passing the three-eighths inch (3/8") sieve and not more than six (6%) percent passing the No. 200 sieve.

3. The composition of the mixture shall conform to the following limits by weight:

	Percent
Total Mineral Aggregate	92.0 – 96.5
Asphalt Cement	3.5 – 8.0

4. Job-mix formula. Prior to preparing any of the mixture on the project, the contractor shall submit for the Engineer's approval, a job-mix formula for the mixture to be supplied for the project. No mixture will be accepted for use until the job-mix formula for the project is approved by the Engineer. The job-mix formula shall be within the gradation range specified, and shall include the type and sources of all materials, the gradations of the aggregates, and the relative quantity of each ingredient, and shall state a definite percentage for each fraction of aggregate. No job-mix formula will be approved which does not permit within the limits specified in Paragraphs 3a and 3c, the full tolerances specified in Paragraph 3 (e)herein for asphalt cement and not less than one-half (1/2) the tolerances designated for material passing the No. 10 sieve and the material passing the No. 200 sieve. The job-mix formula approved for the mixture shall be in effect until modified in writing by the Engineer. When unsatisfactory results or other conditions make it necessary, or should a source of material be changed, a new job-mix formula may be required.

5. Changes in proportions. The Engineer will make such changes in the proportions of asphalt cement and aggregates as he considers necessary within the limits of the specifications. The proposed mixture will be compacted and tested in the laboratory in accordance with AASHTO T 167 and the bulk specific gravity will be determined in accordance with the procedures described in AASHTO T 165.

   The mixture of mineral aggregate and asphalt cement shall result in a bituminous mixture, which will be durable and retain satisfactory cohesion in the presence of moisture. Chemical additions approved in writing by the Engineer may be made to the asphalt cement or to the mixture.

6. Gradation control. In producing mixtures for the project, the plant shall be so operated that no intentional deviations from the job-mix formula are made. Mixtures as produced shall be subject to the following tolerances and controls:

   a. Total aggregate gradation shall be within the master range specified in Paragraph 3a, herein.

   b. Maximum variations from the approved job-mix formula shall be within the following tolerances: Passing No. 10 sieve +/- 5.0 % points Passing No. 200 sieve +/- 2.0 % points

   c. Quantity of Asphalt Cement introduced into the mixer shall be that quantity specified in the job-mix formula. No change may be made in the quantity of asphalt cement specified in the job-mix formula without written approval of the Engineer. The quantity of asphalt cement determined by calculation or tests on the final mixture shall not vary more than +/- 0.5 percentage points from the job-mix formula.

7. Commercial Mixture. The contractor may, at his option, use an approved commercial moisture. The contractor shall, at least seven (7) days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture he proposed to furnish. The statement shall include (1) the types and sources of aggregate, percentage range of each, and range of combined gradation; (2) the percent and grade of asphalt; and (3) the mixing time and range of mixture temperature. The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. If the proposed mixture and plant are approved by the Engineer, the component materials and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall furnish with each truck load, a certification in triplicate that the materials and mixture delivered are in conformance with this approved proposal. The mixture shall be transported, placed, and compacted in accordance with the requirements specified hereinafter.

d. Construction Requirements.

1. Weather Limitations. Bituminous mixtures shall not be placed (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 35 degrees F and falling, (2) on any wet or frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.

2. Subgrade Preparation. The subgrade upon which bituminous surface course is to be placed shall be prepared in accordance with the requirements of Section III of the Specifications. If the bituminous surface course is to be placed upon the top of a completed base course or existing hard surfaced pavement, then the base course or existing pavement, then the base course or existing pavement will be considered the subgrade for the next operation.

3. Tack Coat.

   a. Material. The asphalt cement material used for tack coat shall be emulsified asphalt meeting the requirements of AASHTO M140 or M208, and shall be Grade SS-1 or SS-1H as designated by the Engineer.

   b. Preparation of Surface. The existing surface shall be free of all dust, loose material, grease, or other foreign material at the time the tack is applied. Any fat bituminous surface mixture or bituminous joint material will be removed by others without cost to the contractor before the tack is applied. The surface shall be dry when the tack is applied, except in the case of emulsified asphalt.

   c. Application. Bituminous material shall be applied uniformly with a pressure distributor at the rate specified in the contract, or as revised by the Engineer to be within a minimum of 0.02 and a maximum of 0.10 gallon per square yard. In using emulsified asphalt, water may be added to the material and mixed therewith in such proportion that the resulting mixture will contain not more than fifty (50) percent of added water, the exact quantity of added water to be

specified by the Engineer. The application of the resulting mixture shall be such that the original emulsion will be spread at the specified rate. The tack material shall be heated at the time of application to a temperature specified in the table below. The tack material shall be properly cured and the tacked surface shall be cleaned of all dirt and surplus sand before the next course is placed.

Application Temperatures				
Bituminous Material	Temperature, Degrees Fahrenheit			
	Spraying		Mixing	
	Min.	Max.	Min.	Max.
Asphalt Emulsions SS1	75	130	75	130
SS1H	75	130	75	130

The tack coat shall be applied in such a manner as to cause the least inconvenience to traffic. The tack may be applied full width, provided the tacked surface is blotted with sand in such quantity as specified by the Engineer before it is opened to traffic.

d. Transportation. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth, metal beds which have been thinly coated with a minimum quantity of paraffin oil, lime solution, or other approved material to prevent the mixture from adhering to the bed. Each load shall be covered with canvas or other suitable material or sufficient size to protect the mixture from the weather. When necessary, truck beds shall be insulated so that the mixture will be delivered on the road to meet the requirements of Paragraph 4e. No loads shall be sent out so late in the day that spreading and compacting of the mixture cannot be completed during daylight.

e. Spreading. The base course, primed surface, or preceding course or layer shall be cleaned of all dirt, packed soil, or any other foreign material prior to spreading the bituminous mixture. When delivered to the roadbed, the mixture shall be at a temperature which will permit proper placement and compaction. It shall be spread with an approved spreading and finishing machine in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. The paver shall be operated at a speed that will give the best results. The rate of delivery of the mixture to the paver shall be coordinated so as to provide, where practicable, a uniform rate of placement without intermittent operation of the paver. The compacted thickness of a single layer shall not exceed two (2) inches for the surface course and four (4) inches for the leveling course. On small areas, and on areas which are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods when permitted by the Engineer.

1. Surface Condition. The mixture shall be spread without tearing the surface and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall

be removed and replaced with suitable mixture. The outside edges of the pavement shall be constructed to an angle of approximately forty-five (45) degrees with the surface of the roadbed. The outside edge alignment shall be uniform and any irregularities shall be corrected by adding or removing mixture before compacting.

f. Spot Wedging and Leveling Course. Leveling course, consisting of a layer of variable thickness used to eliminate irregularities in the existing surface, shall be spread to the desired grade and cross section. Rigid control of the placement thickness of the leveling course will be required. Spot wedging operations over small areas, with featheredging at high points and ends of spot areas, may be required prior to placing the leveling course. The use of an approved finishing machine will be required on the spot wedging and the leveling course, except that the spreading of the spot wedging with a blade grader will be permitted if results indicate the mixture is practically free from segregation.

g. Joints. Longitudinal and transverse joints shall be carefully made and well bonded. Transverse joints shall be formed by cutting back on the previous run so as to expose the full depth of the layer. A single lane of any layer shall not be constructed to a length for which the adjacent lane cannot be completed the succeeding operating day. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately six (6) inches; however, the joints in the final layer shall be at the lane lines of the travel way.

h. Surfaced Approaches. At locations designated in the contract or as specified by the Engineer, approaches shall be tacked in accordance with Paragraph 4c and surfaced with a plant mix bituminous mixture. The bituminous surface shall be placed in accordance with the details shown on the typical section or as specified by the Engineer. Approaches shall not be surfaced until after the surface course adjacent to the entrance is completed. No direct payment will be made for any work required to condition and prepare the subgrade on the approaches.

i. Compaction. The mixture shall be thoroughly compacted by at least three (3) complete coverage's over the entire area with either a pneumatic tire roller weighing not less than ten (10) tons. All rollers used shall be in satisfactory condition, capable of reversing without backlash, and steel wheel rollers shall be equipped with scrapers. Rollers shall have a system for moistening each roller or wheel. Rolling shall begin as soon after spreading the mixture, as it will bear the weight of the roller without undue displacement. Final rolling shall be done by the steel wheel roller. Rolling shall be performed at proper time intervals and shall be continued until there is no visible evidence of further consolidation and until all roller marks are eliminated.

j. Surface Tolerances. The finished courses shall have the nominal thickness shown on the plans and shall be substantially free from waves or irregularities. The final riding surface, except on medians and similar areas, shoulders, and temporary

bypasses shall not vary from a ten (10) foot straightedge, applied parallel to the centerline, by more than one eighth (1/8) inch. At transverse construction joints, the surface of all layers shall not vary from the ten (10) foot straightedge by more than one fourth (1/4) inch. Surfaces exceeding these tolerances shall be re-rolled, replaced, or otherwise corrected in a manner satisfactory to the Engineer.

The surface of the mixture after compacting shall be smooth and true to the established crown and grade. Any mixture showing an excess of asphalt cement or that

k. Tolerance in Pavement Thickness. It is the intent of these specifications that the plant mix bituminous surface course shall be constructed strictly in accordance with the thickness shown on the plans. The total thickness of both the plant mix bituminous surface course and the plant mix bituminous base course will be measured, and where the total thickness is found to be deficient, corrective actions will be taken as indicated hereinafter.

The total combined thickness of the bituminous surface course and the bituminous base course will be measured and determined by average caliper measurement of cores. For the purpose of determining the constructed thickness, ten (10) cores per mile will be taken at random intervals in each traffic lane. In addition, cores may be taken at other locations as may be determined by the Engineer. If the measurement of any core is deficient in excess of one-half (1/2) inch from the plan thickness, additional cores will be taken at twenty-five (25) foot intervals parallel to centerline ahead and back of the affected location until the extent of the deficiency has been determined.

It will be assumed that each core is representative of the total combined thickness for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement section.

In those areas of deficient thickness in excess of one-half (1/2) inch that cannot be corrected without affecting the plan crown and grade, the Director of Public Works has the option of requiring removal of the entire bituminous pavement and replacing it with bituminous base course and bituminous surface course of proper thickness or leaving the bituminous pavement in place and requiring the following deductions in payment.

Deficiency in Thickness	Deduction Percent of Contract Unit Price
0 inch to ½ inch	None
Over ½ inch and not over ¾ inch	50
Over ¾ inch and not over 1 inch	100

No additional compensation will be allowed the contractor for any plan mix bituminous pavement constructed in excess of the thickness requirements of the plans and specifications. The surface from which the cores have been taken shall be restored by the contractor within 48 hours using a mixture acceptable to the Engineer.

If removal of the pavement is required, the contractor will be required to remove the pavement and to replace it with one of a satisfactory quality and thickness which, when accepted, will be included in the pay quantities. No payment will be made for any costs incurred in the removal of the pavement deficient in thickness or for the original pavement placement.

e. Deficient Pavement on Private Projects. Prior to acceptance of private projects by the City, cores will be taken to determine pavement thickness. In those areas of deficient thickness that cannot be corrected without affecting the plan crown and grade, the Director of Public Works has the option of requiring removal of the entire bituminous pavement and replacing it with bituminous base course and bituminous surface course of proper thickness or leaving the bituminous pavement in place and receiving a remittance to the City in an amount equal to the value of deduction shown in Paragraph 4, above. This amount is to offset future maintenance costs necessary because of the deficient pavement. Pavement deficient in thickness in excess of one (1) inch will not be accepted.

f. Method of Measurement. Final measurement of plant mix bituminous surface course will be made to the nearest one-tenth (1/10) square yard.

g. Basis of Payment. Payment for plant mix bituminous surface course shall be paid on a square yard basis and shall include all labor, material, and equipment to construct plant mix bituminous surface course in place. Tack coat will be considered incidental to said construction unless specified separately in the specifications.

D. Rigid Pavements

1. Portland Cement Concrete

a. Scope of Work. The concrete described herein shall consist of a mixture of Portland cement, fine aggregate, coarse aggregate, an air-entraining agent and water combined in the proportions specified for the various classes of concrete used in construction work and as set forth in these specifications.

b. Materials.

1. Cement. Cement shall be a standard brand Portland cement which shall conform to the ASTM C-150. Type 1 cement shall be used unless otherwise provided in the special provisions.

- Different brands or different types of cement from the same mill or the same brand or type from different mills shall not be mixed or used alternately in the same item of construction unless authorized by the Engineer.

- The contractor shall not store cement at the site of the work without prior approval of the Engineer.

- The right is reserved by the City to sample the cement either at the origin of the shipment or after delivery at the site of the work or the ready-mix concrete plant. Provisional acceptance by the City prior to the completion of tests shall in no way act as a waiver of the right to reject cement which has been shipped and unused, if upon completion of the tests, it fails to meet the requirements of the specifications.

2. Water. Water used with cement in concrete or mortar shall be clean, clear, free of sugar, and shall be free from injurious quantities of oil, acid, alkali, salt, organic matter, vegetable matter, or other deleterious substances.

3. Fine Aggregate. Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof. The gradation requirements of fine aggregate shall be as follows:

Passing 3/8 inch Sieve	100 percent
Passing No. 4 Sieve	95 – 100 percent
Passing No. 16 Sieve	40 – 8 0 percent
Passing No. 50 Sieve	5 – 30 percent
Passing No. 100 Sieve	0 – 10 percent

Fine aggregate shall conform to the requirements of ASTM C-33 with respect to deleterious substances, soundness, and abrasion.

4. Coarse Aggregate. The coarse aggregate shall consist of crushed stone or crushed gravel of uniform quality. The gradation requirements of the coarse aggregate for Class "A" concrete shall be as follows:

Passing 1 inch Sieve	100 percent
Passing 3/4 inch Sieve	90 – 100 percent
Passing 1/2 inch Sieve	40 – 6 0 percent
Passing 3/8 inch Sieve	10 – 3 0 percent
Passing No. 4 Sieve	0 – 5 percent

The gradation requirements of the Coarse aggregate for Class "X" concrete shall be as follows:

Passing 1 inch Sieve	100 percent
Passing 1/2 inch Sieve	25 – 60 percent
Passing No. 4 Sieve	0 – 10 percent
Passing No. 8 Sieve	0 – 5 percent

Coarse aggregates shall conform to the requirements of ASTM C-33 with respect to deleterious substances, soundness, and abrasion.

5. Air-Entrainment. The air-entrainment shall be obtained by the use of an approved, air-entraining admixture conforming to the ASTM C260, which shall be added during the process of mixing the concrete. Air-entraining Portland cement shall not be used. The admixture shall be dispensed by means of a mechanically-activated dispenser approved by the Engineer, except that in the case of ready-mix concrete the flow may be started manually, and the flow shall shut off automatically when the required amount is delivered. The air-entraining admixture shall be introduced into the stream of mixing water, and the required amount shall be fully discharged before all the mixing water has entered the drum. The tank feeding the dispenser shall at all times contain an amount of air-entraining admixture sufficient for the next batch and shall be provided with a device approved by the Engineer for indicating visually when the supply runs low.

6. Fly Ash. Fly Ash shall conform to ASTM C-618.

c. Portions of Materials

1. Cement Content. Class "A" concrete shall contain not less than 470 pounds of cement per cubic yard.

2. Water Content. The mixing water, including free surface moisture on the aggregate, shall not exceed six (6) gallons per sack of cement.

3. Air Content. Portland cement concrete shall have an air content of not less than three (3) percent, nor more than six (6) percent, of the volume of the concrete when tested in accordance with ASTM C-173.

4. Fly Ash Content. The Portland cement concrete shall contain 100 pounds of fly ash per cubic yard.

5. Slump. The slump, when tested in accordance with ASTM C-143 shall be from one (1) inch to three (3) inches.

6. Mix Proportions. In addition to the above requirements, the concrete materials shall be proportioned so as to provide a uniform workable mix.

Prior to the beginning of construction, the Engineer may require the contractor to furnish a written statement giving the properties of the materials and the proportions by weight (dry) of cement and of the fine and coarse aggregates that are proposed to be used in each class of concrete.

d. General Requirements

1. Cold Weather Protection. Paving operations shall be discontinued when a descending ambient temperature away from artificial heat reaches 40 degrees F and not resumed until an ascending ambient temperature away from artificial heat reaches 35 degrees F. If it is necessary for the contractor to take precautionary measures to prevent damage by freezing, such as heating mixing water, heating aggregates, or applying heat directly to the contents of the mixer; aggregates shall not be heated higher than 150 degrees F, and the temperature of the aggregates and mixing water combined shall be no higher than 100 degrees F, when the cement is added. The temperature of the mixed concrete when heating is employed shall not be less than 50 degrees F, and no more than 90 degrees F a t the time of placement. Use of the additional admixtures may be approved by the Engineer in special cases. Cement or fine aggregate containing lumps or crusts of hardened materials or frost shall not be used. Concrete shall not be placed upon a frozen subgrade.

2. Delivery. Ordinarily, the concrete shall be delivered to the job site in trucks so designed and operated that the concrete will be thoroughly mixed during the time it is in transit and shall be discharged at the site within a period of one and one-half (1 1/2) hours after the introduction of the mixing water. When concrete is placed at the job site, it shall have the proper consistency and slump for satisfactory workability. The temperature of the concrete shall not be greater than 95 degrees F a t the time of placement.

3. Testing. Unless otherwise set out in the Special Provisions, testing shall be at the expense of the City.

2. Portland Cement Concrete Pavement and Integral Curb

a. Scope of Work. The work shall consist of furnishing all labor, materials, and equipment necessary to perform all operations in connection with construction of Portland Cement Concrete pavement, in accordance with the specifications and drawings, subject to the terms and conditions of the contract.

b. Materials.

1. Class "A" Concrete shall be Portland Cement Concrete in accordance with Chapter VII, paragraph D of these Specifications.

2. Reinforcing steel, if specified by the plans, shall consist of deformed bars of grade 40 steel conforming to the requirements of ASTM A615 or of wire fabric conforming to ASTM A185.

3. Expansion joints shall be pre-formed expansion joint fillers of a non-extruding type conforming to ASTM D1751.

4. Joint sealing compound for contraction and construction joints shall be one of the following types of material.

   a. Hot pour polymer rubber asphaltic sealer. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Any excess sealer shall be removed from the pavement immediately after sealing. The specified sealer requires a special pot and the recommended pour temperature is 390 degrees F. This material shall conform to ASTM D3405 and a certification shall be required from the contractor certifying the joint sealer meets this specification. The City reserves the right to inspect and evaluate the equipment that will be used to perform this operation; or

   b. Cold pour polymer fortified crack fill material. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered, dry compressed air at a minimum pressure of 80 psi. Fill each joint with sealer slightly above the pavement surface (some shrinkage will occur). Allow sealant to cure two (2) to twelve (12) hours. Do not apply sealer if ambient temperature is below 50 degrees F. This material shall generally conform to ASTM D- 1190 and a certification shall be required from the contractor certifying the joint sealer meets this specification.

   A certification is required from the contractor certifying that the joint sealer meets this specification and is responsible for its condition up to six (6) months after acceptance of project.

5. Metal supports for tie bars or reinforcing bars shall be channel shaped pressed out of 12-gauge sheet steel or heavier or as shown on the plans.

6. Dowel bars, where specified, for transverse joints shall be smooth, round bars of the size specified. Burrs, mill scale, and rust shall be removed. The free end shall be painted with a suitable paint followed by a thin uniform coating of graphite grease.

7. Expansion tubes or dowel caps shall be manufactured from 32-gauge sheet metal, shall be indented to provide a limiting stop for the dowel bar, and shall provide unobstructed expansion space of not less than one (1) inch to permit movement of the dowel bar. They shall be of proper size to fit the specified bars tightly and the closed end shall be watertight.

8. Curing compound shall be an approved curing compound conforming to the requirements of ASTM C309, Type 2.

9. Type 5 aggregate shall conform to the following requirements:

   Type 5 aggregate base shall be essentially crushed stone, sand and gravel. It shall not contain more than fifteen (15) percent deleterious rock and shale. Sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 sieve in the finished product. Any sand, silt, and clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. The aggregates shall conform to the following gradation requirements:

	Percent
Passing 1-inch sieve	100
Passing 1/2-inch sieve	60-90
Passing No. 4 sieve	40-60
Passing No. 40 sieve	15-35

   The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six (6).

c. Construction Methods

1. Four (4) inches of Type 5 Aggregate base shall be placed under all concrete pavements and shall extend 1'-0" beyond the back of curbs or edge of pavement. The aggregate material shall be compacted to not less than 95% of Standard maximum density. Moisture shall be added to the material during compaction only when it is necessary to obtain the required density. Measurement for payment of the aggregate shall be by truck ticket or computed to the lines and grades of the aggregate on plans and weighing one hundred sixteen (116) pounds per inch per square yard plus five (5) percent for moisture, whichever is smaller. All extra aggregate used under pavements shall be the contractor's responsibility. Once aggregate is in place, the inspector will perform the necessary tests to ensure four (4) inch minimum depth, if aggregate is less than four (4) inch in depth, then aggregate shall be removed and subgrade lowered to obtain four (4) inches in depth. Concrete pavement will not be placed until aggregate subgrade is approved by the City of Farmington.

2. Forms shall be made of metal and shall have a depth equal to or greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section of form shall be uniform and free from undesirable bends or warps.

   The maximum deviation from planned grade of the top surface of any section shall not exceed one- eighth (1/8) inch, or the inside face not more than one-fourth (1/4)

inch from planned alignment. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured as to resist the pressure of the concrete when planed, and the impact when planed, and the impact and vibration or any equipment which they support, without springing or settlement.

Each ten (10) foot length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five (5) feet, having the end brace and socket not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is one hundred and fifty (150) feet or less.

The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. Forms shall be joined neatly and in such a manner that the joints are free from play or movement in any direction. The supply of forms shall be sufficient to permit their remaining in place for at least twelve (12) hours after the concrete has been placed. All forms shall be cleaned and oiled prior to use.

The alignment and grade elevations of the forms shall be checked by the contractor and the necessary corrections made immediately before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

3. Placing Sub-base. The subgrade shall be moist, but not muddy, at the time of the placing of the sub-base. If required by the Engineer, the prepared subgrade shall be saturated with water the previous night, or not less than six (6) nor more than twenty (20) hours prior to placing the concrete. If the subgrade subsequently becomes too dry, it shall be sprinkled again ahead of placing the sub-base, in such a manner as not to form mud or puddles of water.

   Contractor shall give the Engineer at least eight (8) hours advance notice before placing sub-base material and shall be checked and approved by the Engineer after it has been properly compacted.

4. Placing Concrete. The subgrade shall be moist, but not muddy, at the time of the placing of the concrete. If required by the Engineer, the prepared subgrade shall be saturated with water the previous night, or not less than six (6) nor more than twenty (20) hours prior to placing the concrete. If the subgrade subsequently becomes too dry, it shall be sprinkled again ahead of placing the concrete, in such a manner as not to form mud or puddles of water.

   Contractor shall give the Engineer at least eight (8) hours advance notice before placing concrete and the subgrade shall be checked and approved by the Engineer before any concrete is placed.

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subgrade to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly as possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated with suitable tools so that the formation of voids or honeycomb pockets is prevented.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along and outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

5. Consolidating and Finishing. The pavement shall be struck off and consolidated with mechanical finishing machine or by hand-finishing methods. When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the elevations as shown on the plans. A depth of excess concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed, which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

   When hand finishing is used, the pavement shall be struck off and consolidated by a vibrating screed or other approved equipment to the elevation shown on the plans. The vibrating screed must be approved by the Engineer, prior to placement of concrete. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off and not be allowed to idle on the concrete. Internal mechanical vibration shall be used alongside all formed surfaces. Vibration operation shall be completed prior to final hand finishing.

6. Floating, Straightening, and Edging. After the concrete has been struck off and consolidated, it shall be further smoothed by means of a wood or aluminum float at least five (5) feet wide with a handle long enough to reach the entire width of the slab being placed. The float shall be operated so as to remove any excess water and laitance, as well as surface irregularities. After the floating operation, the pavement surface should be within the specified tolerances.

While the concrete is still plastic, the slab surface shall be tested for smoothness with a ten (10)-foot straight edge swung from handles three (3) feet longer than one-half the width of the slab. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than five (5)-foot intervals transversely. After each test, the straight edge shall be moved forward one half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall again be floated with the wooden float and again straight edged. The pavement surface shall have no depression in which water will stand. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans.

7. Final Surface Finish. A broom finish shall be used as the final finishing method. A hard bristle broom shall be used, which shall be kept clean and used in such a manner as to provide a uniform texture surface. The curb shall have the same final finish as the pavement.

   The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive roughness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

8. Joints. Longitudinal and transverse joints shall be constructed as shown on the plans or standard drawings.

   Longitudinal joints are those joints parallel to the lane of construction. They may be either center joints or the construction joints between construction lanes.

   Transverse joints shall be contraction joints or construction joints. Construction joints are put in transversely whenever construction operations require them.

   Expansion joints may be either longitudinal or transverse. They are used only where specifically shown on the plans or standard drawings.

   The edges of the pavement and those joints where such edging is shown on the plans shall be rounded with an edger having a radius of not larger than 1/8 inch. Transverse joints, except keyed and tied construction joints, shall be continuous across the entire paved area including the curb.

   a. Transverse Joints. Transverse joints shall be contraction, expansion, or construction joints. Contraction and expansion joints shall be placed as indicated on the plans and construction joints wherever construction may require them. They shall make a right angle with the centerline of the pavement and with the surface of the subgrade.

Expansion joints shall be installed in accordance with the size and locations shown on the plans, and shall conform to the "Materials" requirements of these specifications. They shall extend the entire width and thickness of the pavement and shall conform to the exact configuration of the curb section. The filler shall be held accurately in place during the placing and finishing of the concrete by means of a bulkhead, a metal channel cap, or other approved methods.

Under no circumstances shall any concrete be left above or below the expansion material or across the joint at any point. Any concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed.

Transverse contraction joint shall be of the sawed type, unless otherwise shown on the plans. Care must be taken to saw the joints soon after concrete placement to prevent contraction cracks. All transverse joints shall be sawed at least one third (1/3) of the slab depth. Any procedure for sawing joints that result in premature or uncontrolled cracking shall be revised immediately by adjusting the time interval between the placing of the concrete and the cutting of the joints.

Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever the placing of concrete is suspended for more than thirty (30) minutes. A butt-type joint with dowels shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tie bars are used if the joint occurs at any other location.

If joints are to be equipped with dowels, they shall be of the dimension and the spacing and location indicated on the plans. They shall be firmly supported in place, and accurately aligned parallel to the pavement grade and the centerline of the pavement by means of a dowel support which will remain in the pavement and will ensure that the dowels are not displaced during construction. One-half of each dowel shall be painted and greased and in an expansion joint, one end shall be equipped with a tight-fitting expansion tube of the dimensions shown on the plans and conforming to the "Materials" requirements of these Specifications.

b. Longitudinal Joints. Longitudinal joints shall be placed as shown on the plans or standard drawings. They shall be of the sawed or the keyed construction type, unless otherwise shown on the plans.

Sawed longitudinal center joints shall be sawed grooves made with a concrete saw after the concrete has hardened. The saw cut shall be at least one fourth (¼) of the slab depth. These joints are otherwise formed in the same manner as the transverse sawed joints entitled "Transverse Contraction Joints."

Longitudinal keyed construction joints (i.e., joints between construction lanes) shall be of the dimensions shown on the plans or standard drawings.

c. Tie bars. Tie bars or tie bolts when shown on the plans or standard drawings shall be of deformed steel and of the dimensions and at the spacing specified. Tie bars shall be firmly supported by subgrade chairs or so installed as not to be displaced during construction operation.

d. Joint Sealer. After the curing period, all sawed and dummy groove joints in the pavement shall be cleaned and sealed as follows. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Joints shall be lightly underfilled (about ½ inch) to prevent extrusion of sealer. Any excess material has to be removed from the pavement as soon after sealing as possible. The type of sealer used must be one of the sealer materials listed in the material section for joint sealing compound.

9. Structures. All manholes, catch basins, or structures of a permanent nature encountered in the area to be paved shall be raised or lowered as the case may be, to the surface of the new pavement, and the necessary expansion joint material placed around each structure for the full depth of the slab and of the thickness shown on the plans of standard drawings. Payment for this work shall be in accordance with Section VII of these specifications.

10. Curing. Immediately after the finishing operation has been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be sealed by spraying with a uniform application of curing compound, at the rate of one (1) gallon for each 150-square feet of surface. If rain falls on the newly coated surface before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the contractor will be required to apply additional curing material to the affected portions.

11. Tolerance in Pavement Thickness. It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the plans. The thickness of the pavement will be measured, and where any pavement is found deficient in thickness, it may be compensated for at an adjusted unit price or shall be removed and replaced.

The thickness of the pavement will be determined by average caliper measurement of cores. For the purpose of determining the constructed thickness of the pavement, ten (10) cores per mile will be taken at random intervals in each traffic lane. In addition, cores may be taken at other locations as may be determined by the Engineer. If the measurement of any core is deficient in excess of one-quarter (1/4) inch from the plan thickness, additional cores will be taken at twenty-five (25)-foot intervals parallel to centerline ahead and back of the affected location until the extent of the deficiency has been determined.

It will be assumed that each core is representative of the pavement thickness for a distance extending one-half (1/2) the distance to the next core, measured along

centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement section.

The drilling of cores in irregular areas, or on projects involving less than 2,500 square yards of concrete pavement, may be waived by the Engineer. In this case the designed thickness will be considered as the measured thickness.

12. Protection and Opening to Traffic. The contractor shall protect the pavement against all damage prior to final acceptance of the work by the Engineer. Traffic shall be excluded from the pavement by erecting and maintaining barricades and signs for at least seven (7) days, or until the concrete pavement achieves a strength of 3,000 pounds per square inch.

13. Paving by Slip Form. Slip-forming equipment will be accepted providing it produces a paving operation in compliance with all the foregoing requirements other than forms.

d. Method of Measurement. Final measurement will be made to the nearest 1/10 square yard for acceptable concrete pavement in place.

e. Basis of Payment.

1. Concrete pavement without integral curb shall be paid on a square yard basis and shall not include any curb or gutter. Curb and gutter shall be paid as a separate item.

2. Concrete pavement with integral curb shall be paid on a square yard basis and shall be measured to the face of the curb. Integral curb shall be paid as a separate item.

Concrete pavement shall include all labor, equipment, and materials necessary for the completion of the pavement in place including excavation, backfill, grading, and all other work incidental to the completion of the street.

If any core measurement is deficient, the Director of Public Works shall have the option of requiring removal and replacement of the pavement at the contractor's expense or requiring the contractor to leave the deficient pavement in place and requiring the following deductions in payment.

Deficiency in Thickness	Deduction Percent of Contract Unit Price
0 – ¼ inch	None
Over ¼" and not over ½"	20
Over ½" and not over ¾"	50
Over ¾" and not over 1"	100

The above deductions will be applied to a section of pavement twenty five (25)-feet long and extending from the edge of the pavement to a longitudinal joint in that

section of pavement in which the deficient measurement was found. Deductions for deficient thickness or damaged pavement will be entered on any estimate after the information becomes available.

If removal of the payment is required, the contractor will be required to remove the pavement and to replace it with one of a satisfactory quality and thickness which, when accepted, will be included in the pay quantities. No payment will be made for any costs incurred in the removal of the pavement deficient in thickness or for the original pavement placement.

a. Deficient Pavement on Private Projects. Prior to acceptance of private projects by the City, cores will be taken to determine pavement thickness. If the pavement is found to be deficient in thickness, the Director of Public Works has the option of requiring removal of the entire deficient pavement or having the contractor or Developer remit to the City an amount equal to the value of the deduction shown in Paragraph 5 above. This amount is to offset future maintenance costs necessary because of the deficient pavement. Pavement deficient in thickness in excess of one (1) inch will not be accepted.

E. INCIDENTAL CONSTRUCTION

1. Concrete Medians

a. Scope of Work. This work shall consist of constructing concrete medians and median strips. Concrete medians shall consist of a paved median constructed on a prepared subgrade. Concrete median strips shall consist of paved median strips laid over and tied to a previously constructed pavement.

b. Materials. Concrete medians and concrete median strips shall be constructed of Class A concrete.

c. Construction Methods. Placement, finishing and curing of concrete shall be in accordance with the specifications stated in this chapter for Concrete Pavement.

1. When items are constructed on a subgrade, the subgrade shall be compacted to the specified density of the applicable subgrade material in accordance with the specifications stated in Chapter III. The subgrade shall have a sufficient moisture content such that moisture is not drawn out of the concrete.

2. Where tinted concrete is specified, the colored pigment shall be applied in accordance with the manufacturer's recommendations. The final concrete surface coloration shall be approved by the City prior to placement. If a membrane curing is allowed by the manufacturer's recommendations, the membrane shall be a clear or transparent type.

3. Required reinforcement and tie bars shall be positioned by bar chairs or other approved devices during the placing of concrete.

4. Concrete median strips shall be attached to the pavement with tie bars as shown on the plan. Tie bars shall be adjusted to a minimum of six (6) inches from any transverse joint.

5. Joint for all items shall be constructed at such intervals and locations as shown on the plans or as directed by the engineer.

6. Longitudinal joints between the median and curb, or median and adjacent concrete pavement shall be constructed of either non-extruding preformed joint material, or one layer of commercially available 55-pound roll roofing. Sawed joints shall be sealed.

7. Transverse joints in concrete median strips shall be constructed as shown on the plans or as directed by the engineer.

d. Method of Measurement.

Measurement of the concrete medians and concrete median strips shall be made to the nearest one-tenth (1/10) square yard.

e. Basis of Payment. The accepted quantities of concrete median and concrete median strip will be paid for at the contract unit price for each item included in the contract.

2. Stone Rip Rap Facing

a. Scope of Work. Stone riprap facing shall consist of constructing a rock ditch or slope to form a stable protection of the required section.

b. Materials. Stone shall be sound, durable, hard, resistant to abrasion, and free from laminations, weak cleavage planes, and the undesirable effects of weathering. It shall be of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. All materials shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings.

1. The stone shall be shot rock with a maximum size of twenty- four (24) inches, chinked rock shall be no smaller than four (4) inches in diameter and the maximum depression in any face will be six (6) inches. The stone shall be even graded between four (4) inches and twenty four (24) inches

2. Each piece of facing stone shall have its greatest dimension not greater than three (3) times its least dimension and shall have an apparent specific gravity not less than 2.2 according to ASTM C127.

c. Method of Construction. Each load of stone shall be reasonably well graded from the smallest to the maximum size specified. Control of grading shall be by visual inspection. Stones may be placed by dumping, but some hand work may be needed to achieve proper placement and distribution.

1. The larger stones shall be well distributed, and the entire mass of stones shall be roughly graded to conform to the approximate distribution specified. The finished stonework shall be free from objectionable pockets of small stones and clusters of larger stones.

2. Rocks shall be placed with the longitudinal axis normal to the alignment of the embankment face, and each rock should have a three-point bearing. No rock shall be dependent upon an overlying rock to hold it in place nor shall any rock be dependent upon chinking with smaller rocks to hold it in a temporary stable position.

d. Method of Measurement. Stone Rip Rap Facing will be measured to the nearest cubic yard of material.

e. Basis of Payment. The accepted quantity of Stone Rip Rap Facing, complete and in place, will be paid for at the contract unit price. No direct payment will be made for excavation or for any work necessary to prepare the subgrade for the bedding material.

3. Adjustments of Downspout Drains

a. Scope of Work. The work shall consist of reconnecting existing downspout drains now located in the existing curb into and through the proposed curb or curb and gutter.

b. Material. In general, the relocated drains shall be of the same diameter as the existing drains. Wherever practical existing drains shall be re-laid.

c. Construction Methods. Existing drains are indicated on the plans. The contractor shall exercise care while removing existing curb and excavating between existing curb and new curb or curb and gutter not to damage existing drains. The Engineer in the field shall determine the location of the removal to ensure proper drainage. Usable drain pipe removed shall be cleaned. Existing concrete drains with steel covers shall be removed to the locations indicated by the Engineer and all material disposed of outside of the right-of-way.

Specification for relaying existing or new drains shall conform to specifications included in Chapter V of these specifications. Drain tile shall be poured in place in proposed curb or curb and gutter at locations indicated by the Engineer.

d. Method of Measurement. Measurement of downspout drains will be to the nearest foot.

e. Basis of Payment. Downspout drains shall be paid on a lineal foot basis for all pipe removed and replaced or adjusted at the direction of the Engineer, or as shown on the plan. This shall include all labor, equipment, and material necessary to remove and replace or adjust the downspout drain.

4. Adjustments of Sanitary Sewer Laterals

a. Scope of Work. At many locations, the house connections to the main sanitary sewer located within the present pavement area consist of a riser from the sewer to the point close to the existing pavement subgrade, from this point the connection runs nearly horizontally to the house connection. Experience has indicated that in many instances the house connections are above the elevation of the proposed subgrade, making it necessary to relay house connections at a lower grade. This work shall include all equipment, materials, and labor for the adjustment of sewers to accommodate the paving project. This work shall consist of all work necessary for the lowering of the riser and adjustment in grade to coincide with proposed elevations.

b. Materials. Sanitary sewer pipe shall meet the requirements specified in Chapter V of these specifications.

c. Construction Methods. Extra riser pipe shall be removed to the elevation indicated by the Engineer. Construction methods for riser pipe shall meet the requirements for sewer pipe specified in Chapter V of these specifications.

All existing sanitary sewer pipe removed because of necessary grade adjustments shall be disposed of by the contractor and replaced with new pipe of the diameter required, meeting the specifications as set forth above.

d. Method of Measurement. Measurement of pipe will be to the nearest foot.

e. Basis of Payment. Sanitary sewer house connections shall be paid on a lineal foot basis for all pipe removed and replaced at the direction of the Engineer or as shown on the plans. This shall include all labor, equipment, and materials necessary to remove and replace the sanitary sewer house connections.

5. Adjoining Streets and Alleys

a. All roadways adjacent to the new construction shall be graded for a satisfactory connection with slopes not greater than one (1) foot vertical to fifteen (15) feet horizontal, unless otherwise authorized by the Engineer. All approaches or connections shall be smoothly finished and present a good appearance and provide for proper drainage.

Section 427.070. Concrete Curb and Gutter, Sidewalks, and Driveways

A. CURB AND GUTTER

1. Scope of Work. Furnish all labor, materials, and equipment to perform all operations in connection with construction of concrete curb and gutter, in accordance with the specifications and drawings, subject to the terms and conditions of the contract.

2. Materials.

   a. Class "A" concrete shall be Portland Cement Concrete in accordance with Chapter IX of these specifications. Admixtures shall not be used unless specifically approved by the Engineer.

   b. Expansion joints shall be made with preformed expansion joint filler of a non-extruding type conforming to ASTM Designation D1751, configuration of the curb and gutter as indicated in Standard Drawing ST-2 included in these specifications.

   c. Joint sealing compound for contraction joints shall be one of the following:

      1. Cold pour polymer fortified crack fill material generally conforming with ASTM D- 1190, approved by the Engineer; or

      2. Hot pour polymer rubber asphalt sealer meeting the requirements of ASTM D-3405. A certification will be required from the contractor certifying that the joint sealer meets this specification.

   d. Curing compound shall conform to the requirements of ASTM C309, Type 2.

3. Method of Construction.

   a. Forms shall be made of metal and shall have a depth equal to or greater than the prescribed edge thickness of the pavement slab. The minimum length of each section of form used shall be ten (10) feet. Each section or form shall be uniform and free from undesirable bends or warps.

      The maximum deviation of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from planned alignment. The method of connection between sections shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross- section and strength and so secured as to resist the pressure of the concrete when planed, and the impact where planed, and the impact and vibration of any equipment which they support, without springing or settling.

      Every ten (10) foot length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five (5) feet, having the end brace and socket not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

The sub-base under the forms shall be compacted and at grade so that the form when set will be uniformly supported for its entire length at the specified elevation. Forms shall be joined neatly and in such a manner that the joints are free from play or movement in any direction. The supply of forms shall be sufficient to permit their remaining in place for at least twelve (12) hours after the concrete has been placed. All forms shall be cleaned and oiled prior to use.

The alignment and grade elevations of the forms shall be checked by the contractor and the necessary corrections made immediately before placing the concrete. When any form has been disturbed or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

b. Placing concrete. Contractor shall give the Engineer at least eight (8) hours advance notice before placing concrete and the sub-base shall be checked and approved by the Engineer before any concrete is placed.

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subgrade to the required depth and width of the curb and gutter in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly as possibly in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated with suitable tools so that the formation of voids or honeycomb pockets is prevented.

The concrete shall be especially well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been adjusted to the required grade and alignment.

c. Finishing. The curb shall be tooled to the required radii as soon as possible after the concrete takes its initial set. The gutter shall be shaped with a wood float at least four (4) feet long. After the face forms and templates are removed the joints shall be tooled and the surface shall be final finished with a hard bristle broom to remove all imperfections without additional mortar or dryer. In all cases the resulting surface shall be smooth and of uniform color, free from sags, twists, or warps, and true to the specified lines and grades shown on the plans.

d. Joints.

1. Expansion joints shall be formed with bituminous preformed expansion joints three- quarter (3/4) inch thick or as specified on the plans and precut to exact cross section of curb and shall be placed at all driveway radii and intersection radii and at intervals of not more than five hundred (500) feet, and at the location

shown on the plans or standard drawings, so that they are not moved by depositing and compacting the concrete at these joints. Preformed expansion joint filler shall be of non- extruding type and shall conform to ASTM D1751.

2. Contraction joints shall be sawed or formed with templates at intervals not greater than twenty five (25) feet and at locations shown on the plans or standard drawings. The joint shall be sawed one and one half (1 ½) inches deep. Contraction joints in proposed medians shall match the locations of the joints in the pavement. A template shall be one-quarter (1/4) inch thick, cut to the configuration of the curb section shown on the plans. Templates shall be secured so that they are not moved by depositing and compacting the concrete. As soon as the concrete has hardened sufficiently, the templates shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool of one- eighth (1/8) inch radius. Asphaltic material used in filling these joints shall be as follows:

   i. Hot pour polymer rubber asphaltic sealer. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered and dry compressed air at a minimum pressure of 80 psi. Any excess sealer shall be removed from the pavement immediately after sealing. The specified sealer requires a special pot and the recommended pour temperature is 390 degrees F. This material shall conform to ASTM D3405 and a certification shall be required from the contractor certifying the joint sealer meets this specification The City reserves the right to inspect and evaluate the equipment that will be used to perform this operation; or

   ii. Cold pour polymer fortified crack fill material. Immediately before applying the joint sealer, all loose debris, dust, and moisture shall be removed from the joint with filtered, dry compressed air at a minimum pressure of 80 psi. Fill each joint with sealer slightly above the pavement surface (some shrinkage will occur). Allow sealant to cure two (2) to twelve (12) hours. Do not apply sealer if ambient temperature is below 50 degrees F. This material shall generally conform to ASTM D-1190 and a certification shall be required from the contractor certifying the joint seal meets this specification.

e. Curing. Immediately after the finishing operation has been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be sealer by spraying with a uniform application of a curing compound, at the rate of one (1) gallon for each one hundred fifty (150) square feet of surface. If rain falls on the newly coated surface before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the contractor will be required to apply additional curing material to the affected portions.

f. Cold Weather Protection. Cold weather protection shall be as provided in Section VI of these specifications.

g. Curb and Gutter. Curb and gutter laid by slip- form or extruding equipment will be accepted providing it complies with all of the above requirements other than forms.

h. Backfilling. After curing, the curb shall be immediately backfilled to within four (4) inches of the top of the curb to eliminate any possibility of washing beneath the curb. The remaining four (4) inches shall be topsoil.

4. Method of Measurement. Final Measurement will be made to the nearest lineal foot of acceptable Portland Cement Concrete curb and gutter in place.

5. Basis of Payment. Payment for concrete curb and gutter shall be on a lineal foot basis and include all labor, materials and equipment necessary for the completion of the concrete curb and gutter in place including backfilling and grading.

B. SIDEWALKS

1. General. Sidewalks are generally required in subdivisions and on at least one side of residential streets and on both sides of collector and arterial streets. The outside edge of the sidewalk shall be placed one foot inside of the street right-of-way line. Residential sidewalks shall be a minimum width of five (5) feet.

2. Design. Sidewalks are constructed from Class "A" Portland cement concrete, four (4) inches thick, except 6-inch thickness is required in residential driveways and 8-inch reinforced thickness is required in commercial driveways. These thicknesses shall extend 18 inches on either side of the driveway. All driveway sections shall be placed over 4 inches compacted Type I aggregate base. The sidewalk shall have a cross-slope of one fourth (¼) inch per foot toward the street. The sidewalk slab shall not be longer than six (6) feet nor less than four (4) feet. The sidewalk plan must show the sidewalk in plan, profile, and typical cross section. For sidewalks to be constructed on unimproved streets, it is necessary to obtain sufficient field data to determine the probable future grade of the street curb and design the sidewalk accordingly.

   If street plans are being submitted, the sidewalk must be shown in plan on the street plans and on the typical cross-section. The sidewalk profile may be omitted on streets where curbs are existing or proposed.

3. Expansion Joints. Expansion joints, one-half (3/4) inch thick shall be indicated on the plan on each side of the driveways, at intersecting walks or curbs and other locations as required. If the sidewalk is placed adjacent to the curb and gutter, transverse expansion joints are required to match the expansion joints in the curb and gutter. A three fourths (¾) inch expansion joint shall be used between the sidewalk and the curb.

4. Curb Ramps. Wheel chair ramps are required at all street intersections and at any marked midblock crossings. No structures will be permitted within wheel chair ramp areas. Truncated domes are to be placed only on curb ramps located at intersections of public

streets and signalized intersections. Truncated domes are to be paid for as a separate pay item.

5. Method of Measurement. Final measurement will be made to the nearest one thenth (1/10) square yard of sidewalk and curb ramps placed.

   a. Truncated Domes. Final measurement for truncated domes will be made to the nearest one tenth (1/10) square foot of panel placed.

6. Basis of Payment. Payment for concrete sidewalk and curb ramps will be paid for at the contract unit price for each of the pay items included in the contract.

   a. No Direct Payment will be made for the following:

      1. Furnishing or installing reinforcement.
      2. Any incidental work required for furnishing and installing tie bars
      3. Excavating or preparing the subgrade for any item contained in this specification.
      4. Tinting of concrete surfaces as required in the plans.
      5. Vertical curbs or flares constructed as part of the curb ramp or landing.

C. DRIVEWAYS

1. General. Driveway approaches are located to serve the operation of automobiles and other vehicles from the street pavement to a garage, parking area, building entrance, structure, or other approved use located on the property.

2. Design. Residential driveway approaches shall be constructed using six (6) inch thick Class "A" concrete. Non-residential/commercial driveway approaches shall be constructed using eight (8) inch thick reinforced Class "A" concrete (#4 rebar 18 inches on center with fibermesh equal to the steel volume). When a driveway approach intersects an existing four (4)-inch sidewalk, the area of the sidewalk within the driveway area and for a distance of eighteen (18) inches on each side of the driveway shall be removed and reconstructed with six (6) inch thick concrete or except eight (8) inch thick Class "A" concrete (#4 rebar 18 inch on center or equivalent fibermesh steel). The grade of the driveway approach from the gutter line shall rise on a constant grade to a point five (5) feet from the right-of-way line. The elevation of the point is to be the least one-fourth (1/4) inch above the normal top of curb, and not steeper than three-fourths (3/4) foot for the distance between the curb and the point. The remaining five (5) feet of the approach shall rise at the rate of one-fourth (1/4) inch per foot.

   No driveway approach shall be permitted which will interfere with any existing parking meters, signs, traffic control devices, plantings, cables, poles, guys, water mains, gas mains, or other public utilities. No part of any driveway approach may be located with four (4) feet of a drop inlet or other drainage structure.

No part of any driveway approach shall be located within forty (40) feet of a point on the right-of-way line opposite the end of a raised median.

Joint driveway approaches shall be permitted only if there is a perpetual mutual access agreement approved by the City Attorney and filed of record in the Ste. Francois County Recorder's Office.

The width of residential driveway approaches shall not exceed twenty-two (22) feet and shall not be less than twelve (12) feet for new construction, and not less than the existing approach for reconstruction.

All driveway approaches shall be located to provide the following minimum clearances: Nearest edge of the driveway to nearest right-of-way line of alleys, ten (10) feet; nearest edge of the driveway to property line, five (5) feet; on corner lots, nearest edge of the driveway to nearest right-of-way line of an intersecting street, twenty (20) feet, but in no case shall the driveway return extend closer than fifteen (15) feet to the intersection right-of-way line extended. Where sight distance triangles exist, the nearest edge of the driveway to nearest corner of triangle shall be at least twenty (20) feet.

The edges of driveway approaches may be skewed so that the angle between the street right-of-way line and the edge of the doorway approach is not less than sixty (60) degrees.

The radius of the driveway approach shall be designed based on street classification and shall not, in any case, extend beyond the projection of the adjacent property line, extended perpendicularly to the right-of-way line.

3. Expansion Joints. Three fourths (3/4) inch thick expansion joints shall be used between the edges of the driveway approach and the sidewalk and at the right-of-way line.

4. Sawcutting Curb and Gutter. The curb and gutter section adjacent to the driveway (radius point to radius point) shall be sawcut full depth and removed before placing the new driveway. The section of removed curb and gutter shall be placed at the same time as the driveway approach matching the approach thickness and reinforcement requirements. Any damage to the adjacent curb and gutter and street section shall be the responsibility of the contractor to repair or replace in accordance with the inspector's determination.

5. Method of Measurement. Final measurement will be made from the beginning of the return on one side of the approach to the end of the return on the other side of the approach, to the nearest one tenth (1/10) square yard. Integral curb constructed paved approaches will not be measured or paid for separately but will be included in the contract unit price for paved approaches.

6. Basis of Payment. The accepted quantities of concrete paved approaches will be paid for at the contract unit price of the pay items included in the contract.

No Direct Payment will be made for the following items:

a. Furnishing or installing reinforcement.
b. Any incidental work require for furnishing and installing tie bars.
c. Excavating or preparing the subgrade for any item contained in this specification.

Section 427.080. Concrete Structures

A. SCOPE OF WORK.

This section provides the requirements for Portland Cement Concrete, as well as the construction of concrete retaining walls, mechanically stabilized earth wall systems (MSE), concrete culverts and headwalls, and any other miscellaneous concrete structures, except those covered elsewhere in these specifications.

B. PORTLAND CEMENT CONCRETE

1. DESCRIPTION

The concrete described herein shall consist of a mixture of Portland cement, fine aggregate, coarse aggregate, an air-entraining agent and water combined in the proportions specified for the various classes of concrete used in construction work and as set forth in these specifications.

2. MATERIALS

a. Cement. Cement shall be a standard brand Portland cement which shall conform to the ASTM C-150. Type 1 cement shall be used unless otherwise provided in the special provisions.

1. Different brands or different types of cement from the same mill or the same brand or type from different mills shall not be mixed or used alternately in the same item of construction unless authorized by the Engineer.

2. The contractor shall not store cement at the site of the work without prior approval of the Engineer.

3. The right is reserved by the City to sample the cement either at the origin of the shipment or after delivery at the site of the work or the ready-mix concrete plant. Provisional acceptance by the City prior to the completion of tests shall in no way act as a waiver of the right to reject cement which has been shipped and unused, if upon completion of the tests, it fails to meet the requirements of the specifications.

b. Water. Water used with cement in concrete or mortar shall be clean, clear, free of sugar, and shall be free from injurious quantities of oil, acid, alkali, salt, organic matter, vegetable matter, or other deleterious substances.

c. Fine Aggregate. Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof. The gradation requirements of fine aggregate shall be as follows:

Passing 3/8 inch Sieve	100 percent
Passing No. 4 Sieve	95 – 100 percent
Passing No. 16 Sieve	40 – 8 0 percent
Passing No. 50 Sieve	5 – 30 percent
Passing No. 100 Sieve	0 – 10 percent

Fine aggregate shall conform to the requirements of ASTM C-33 with respect to deleterious substances, soundness, and abrasion.

d. Coarse Aggregate. The coarse aggregate shall consist of crushed stone or crushed gravel of uniform quality. The gradation requirements of the coarse aggregate for Class "A" concrete shall be as follows:

Passing 1 inch Sieve	100 percent
Passing 3/4 inch Sieve	90 – 100 percent
Passing 1/2 inch Sieve	40 – 6 0 percent
Passing 3/8 inch Sieve	10 – 3 0 percent
Passing No. 4 Sieve	0 – 5 percent

The gradation requirements of the Coarse aggregate for Class "X" concrete shall be as follows:

Passing 1 inch Sieve	100 percent
Passing 1/2 inch Sieve	25 – 60 percent
Passing No. 4 Sieve	0 – 10 percent
Passing No. 8 Sieve	0 – 5 percent

Coarse aggregates shall conform to the requirements of ASTM C-33 with respect to deleterious substances, soundness, and abrasion.

e. Air-Entrainment. The air-entrainment shall be obtained by the use of an approved, air-entraining admixture conforming to the ASTM C260, which shall be added during the process of mixing the concrete. Air-entraining Portland cement shall not be used. The admixture shall be dispensed by means of a mechanically-activated dispenser approved by the Engineer, except that in the case of ready-mix concrete the flow may be started manually, and the flow shall shut off automatically when the required amount is delivered. The air-entraining admixture shall be introduced into the stream of mixing water, and the required amount shall be fully discharged before all the mixing water has entered the drum. The tank feeding the dispenser shall at all times contain an amount of air-entraining admixture sufficient for the next batch and shall be provided with a device approved by the Engineer for indicating visually when the supply runs low.

f. Fly Ash. Fly Ash shall conform to ASTM C-618.

3. PROPORTIONS OF MATERIALS

a. Cement Content. Class "A" concrete and Class "X" concrete shall contain not less than 470 pounds of cement per cubic yard.

b. Water Content. The mixing water, including free surface moisture on the aggregate, shall not exceed six (6) gallons per sack of cement.

c. Air Content. Portland cement concrete shall have an air content of not less than three (3) percent, nor more than six (6) percent, of the volume of the concrete when tested in accordance with ASTM C-173.

d. Fly Ash Content. The Portland cement concrete shall contain 100 pounds of fly ash per cubic yard.

e. Slump. The slump, when tested in accordance with ASTM C-143 shall be from one (1) inch to three (3) inches.

f. Mix Proportions. In addition to the above requirements, the concrete materials shall be proportioned so as to provide a uniform workable mix.

Prior to the beginning of construction, the Engineer may require the contractor to furnish a written statement giving the properties of the materials and the proportions by weight (dry) of cement and of the fine and coarse aggregates that are proposed to be used in each class of concrete.

C. RETAINING WALLS

1. Scope of Work. This work shall consist of furnishing and construction concrete retaining walls and mechanically stabilized earth wall systems in accordance with these specifications, as shown on the plans or as directed by the Engineer.

a. Concrete shall be Class "A" Portland Cement Concrete in accordance with the requirements of Chapter VII of these specifications.

b. Reinforcing steel shall consist of deformed bars of grade 40 steel conforming to the requirements of ASTM A615 or of wire fabric conforming to ASTM A185.

c. Expansion joint fillers shall be of a non- extruding type conforming to ASTM D1751 and cut to the dimensions shown on the plans.

d. Bedding Material. Material for bedding shall be crushed stone or crushed gravel conforming to the requirements of ASTM Standard C33, and having a gradation as follows:

	Sieve Size	% Passing
Passing	1/2"	100
Passing	3/8"	30 – 100
Passing	No. 4	0 – 5

e. Geotextile shall be in accordance with the physical and chemical requirements of AASHTO M 288 for the specified application. The geogrid shall be dimensionally stable and shall be able to maintain geometry during transport and installation.

f. Mechanically Stabilized Earth Wall System Blocks.

1. Concrete blocks shall be tested for freeze-thaw durability in accordance with ASTM C1262. Freeze-thaw durability shall be based on tests from five specimens made with the same material, concrete mix design, manufacturing process and curing method conducted not more than 18 months prior to delivery.

2. The acceptance of the compressive strength of the concrete blocks will be based on production lots in compliance with ASTM C140.

3. Dimensional Tolerances. Concrete blocks shall be manufactured within the following tolerances:

   a. The length and width of each concrete block shall be within 1/8 inch of the specified dimension.

   b. The height of each concrete block shall be within 1/16 inch of the specified dimension.

   c. When a broken face finish is used, the dimension of the front face shall be within one inch of the theoretical dimension of the concrete block.

4. All concrete blocks shall be sound and free of cracks or other defects that would interfere with the proper placement of the blocks or significantly impair the strength or permanence of the construction. At the time of the delivery to the work site the concrete blocks shall:

   a. A maximum water absorption of five (5) percent.

   b. Minor cracks incidental to the usal method of manufacture of minor chipping resulting from shipment and delivery will not be grounds for rejection. Minor cracks will be defined as cracks that are no wider than 1/64 inch and no longer than twenty-five (25) percent of the block height.

   c. Any exposed face of a concrete block shall be fee of chips, cracks or other imperfections when viewed from ta distance of thirty (30) feet under diffused

lighting. Up to five (5) percent of the shipment may contain slight cracks or small chips no larger than one inch.

2. Construction Methods.

   a. Forms. Forms shall be of wood, plywood, or any other suitable material, designed, constructed, braced, and maintained so that the finished concrete will be true to line, and elevation will conform to the required dimensions. They shall be designed to withstand the pressure of the concrete, the effect of vibration as the concrete is placed and all other loads incidental to the construction operations, without distortion or displacement. They shall be mortar tight. Oiling both inside and outside surfaces will be required to prevent warping, shrinkage or swelling.

      Forms shall be constructed and designed so that their removal can be effected without injury to the concrete and so that portions where surface finishing is required may be removed without disturbing forms that are to remain. Three-fourths (3/4)-inch chamfer strips shall be placed on all edges to be exposed. Dirt, chips, sawdust, nails, and other foreign matter shall be removed before any concrete is deposited therein.

      Tie rods, belts, and anchorages within the forms shall be constructed so as to permit their removal to a depth of at least one and one half (1 ½) inches from the face without injury to the concrete. In case wire ties are used, upon removal of the forms, all projecting wire shall be cut back at least one half (1/2) inch from the face of all surfaces that will be exposed to view after the completion of the work and flush with the face of all concrete surfaces that will not be exposed to view. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest practical size.

   b. Inlet and Outlet Pipe. Pipe or tile placed in the concrete for inlet or outlet connections shall extend through the concrete walls beyond the outside surfaces of the walls a sufficient distance to allow for connections. The pipe or tile shall be placed through the forms and poured in place.

   c. Falsework. Falsework for concrete masonry construction shall be adequate to support and hold the forms true to lines, camber and grades shown on the plans. If requested by the Engineer, the contractor shall submit detailed plans for falsework, including the supporting design computations. The Engineer's acceptance of the plans will not relieve the contractor of the responsibility for obtaining satisfactory results. The falsework shall be constructed in general accordance with the submitted plans. Falsework and forms for single and multi-span concrete frames and for continuous concrete slab and girder-type bridges shall be provided for the full length of each continuous or monolithic unit and for the full width of the structure before starting concrete placement in that unit. The use of shims or blocking shall be held to a minimum. Jacks shall be placed at approved locations to secure and maintain the required camber. Means shall be provided by the contractor for accurately determining settlement of the falsework while the falsework is

being loaded. The contractor shall correct for any settlement of forms or falsework during the concrete placing process.

d. Reinforcement.

1. Placement. Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with concrete Reinforcing Steel Institute's "Recommended Practice for Placing Reinforcing Bars," and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the top surface of the concrete (except where shown on the plans) and wooden supports, shall not be used.

   Placing bars on layers of fresh concrete as the work progresses, and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rusts, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved by the Engineer.

2. Splicing. Splicing of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least thirty (30) diameters, unless otherwise shown on the plans.

   Splicing space shall be accomplished by placing the bars in contact with each other and wiring them together.

   Welding of reinforcing steel or cutting with a cutting torch will not be permitted unless specifically authorized by the Engineer.

3. Bending Reinforcement. Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the American Concrete Institute.

   Bars shall not be bent or straightened in a manner which will injure the material. Bars with kinks or unspecified bends shall not be used.

4. Welded Wire Fabric. Welded wire fabric shall be spliced no less than two (2) meshes. It shall be lifted carefully into its specified position after the concrete is placed but still plastic.

e. Bedding. The subgrade for the structure shall be excavated a sufficient depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the structure. Bedding material shall be placed and compacted to the proper elevation.

f. Placing Concrete. Concrete shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients.

Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.

Where a sequence for placing concrete is shown on the plans, no deviation will be permitted unless approved in writing by the Engineer.

Where concrete is to be placed against hardened concrete, the hardened concrete shall be wetted immediately before placing the fresh concrete, and then vibrated sufficiently to ensure no voids.

To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened or is contaminated by foreign materials shall not be deposited in the structure.

Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and proceed upgrade unless otherwise permitted by the Engineer. Concrete shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.

Concrete shall not be permitted to fall more than six (6) feet without the use of pipes or tremies. Pipes or tremies shall be at least six (6) inches in diameter, or the equivalent cross sectional area for rectangular sections. Concrete shall not be placed in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a two- (2) hour period has elapsed to permit shrinkage to occur.

Concrete shall be thoroughly vibrated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Structural concrete, except slope paving steeper than one (1) inch per foot, such as spillway aprons and channel lining, and concrete placed under water, shall be consolidated by means of high frequency internal vibrators of a type, size, and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in good operating condition shall be available at the site of the structure in which more than twenty-five (25) cubic yards of concrete is to be placed.

g. Joints. The work shall be so prosecuted that construction joints will occur at designated places shown on the plans unless otherwise authorized by the Engineer. The contractor shall construct, in one continuous concrete placing operation, all work compromised between such joints. Joints shall be kept moist until adjacent concrete is placed.

All construction joints having a keyed, stepped, or roughened surface shall be cleaned prior to placement of the adjacent concrete as directed by the Engineer.

Three fourths (3/4) inch expansion and contraction joints for cast-in-place concrete structures shall be constructed at a minimum distance between joints of fifty (50) feet, and in no case shall exceed seventy five (75) feet. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

No direct payment will be made for furnishing and placing asphaltic paint, pre-molded asphaltic filler, or other types of joint separators. The cost, therefore, shall be included in the price bid for the item of work of which they are a part.

h. Cold Weather Requirements. Whenever the temperature of the surrounding air is below 40 degrees F within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature of between 50 degree and 90 degree F. All concrete shall be maintained at a temperature of no less than 50 degrees F for at least 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing shall remain in place and intact at least twenty-four (24) hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations. No concrete will be placed on a bridge superstructure when the air temperature is less than 40 degrees F.

i. Finishing. The top surfaces of structures shall be struck off with a straight edge and finished with a wood or aluminum float. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with a plastic sheet, burlap, or sprayed with white pigmented membrane curing compound conforming ASTM 309, type 2. Forms shall be removed between four (4) and twelve (12) hours after concrete placement and all exterior form ties shall be removed to a depth of one (1) inch below the surface, all fins caused by forms, joints, and other projections shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

j. Backfilling. Structures which lie within the area to be paved, or within two (2) feet of the back of curb shall be backfilled with granular material meeting the requirements of bedding material specified hereinbefore. Backfill not within two (2) feet of the paving area may be clean earth. Bedding material shall be placed and thoroughly compacted.

Earth backfill shall be placed in accordance with the requirements specified in Chapter VI of these specifications for pipe backfilling.

k. Removal of Forms. Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. On structures such as box culverts, forms shall not be removed until the concrete has attained a strength of 3,000 pounds per square inch. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the requirements for curing and finishing.

l. MSE wall systems will be permitted for uses where the wall height does not exceed ten feet. This limit may be exceeded up to a maximum height of 12 feet to accommodate peaks in the wall or to accommodate lengths of the wall that do not exceed more than ten percent of the total wall length. The height of the wall will be determined by measuring from the top of the concrete leveling pad to the top of the cap on the wall.

m. The contractor shall submit four complete sets of the manufacturer's design plans, details and computations for each individual wall structure to the Engineer. The contractor will be solely responsible for the content of the design plans, details and computations that are submitted, and for the performance of the wall system. The contractor shall be solely responsible for ensuring that the information submitted by the manufacturer is in accordance with all contract plans and specifications and with the wall system used. Completed design plans shall contain all material, fabrication and construction requirements for erecting the wall system complete in place. The completed design plans shall show the longitudinal and lateral layout of the drainage systems used for the wall system. The contractor shall be responsible for the internal and external stability of the structure including compound stability. Overall global stability will be the responsibility of the engineer. All design plans, details and computations submitted for distribution shall be signed, sealed and stamped in accordance with laws relating to architects and professional engineers (Chapter 327, RSMo). MSE systems shall be designed in accordance with the AASHTO specifications shown on the plans and in accordance with additional publications or specifications referenced within the AASHTO specifications. The seismic performance category, angle of internal friction for the selected granular backfill for structural systems and other design requirements shown on the plans shall be incorporated into the design of the wall system.

n. Precast top cap units shall be used on MSE systems. The top cap units shall be permanently attached as shown on the plans, utilizing either a resin anchor system or an equivalent detail.

o. Drainage Requirements of MSE systems. A drainage system shall be provided at the base of the wall system near the facing elements and at the interface of the select granular backfill for structural systems and the retained backfill. The drainage system shall consist of a perforated pipe wrapped in a Class 2 geotextile to prevent clogging of the perforations. The pipe shall be placed in such a manner that water drains freely from the pipe. When the wall length is such that the slope of the pipe becomes excessive in

the engineer's judgment, lateral drain pipes shall be installed underneath the concrete leveling pad.

p. Foundation Preparation. The foundation for the wall system shall be graded level for a width equal to or exceeding the length of the reinforcing strips, or as shown on the plans. Prior to wall construction, the foundation, if not on rock, shall be compacted as directed by the Engineer. Any foundation soils found to be unsuitable shall be removed and replaced, as directed by the Engineer.

q. Leveling Pad. Two types of pads will be allowed for MSE systems.

1. Unreinforced Concrete Leveling Pad. An unreinforced cast-in-place concrete leveling pad shall be provided at the foundation level for each base unit of the wall system. The leveling pad shall be built to the elevations shown on the plans and shall not be raised in elevation to allow for the use of a particular wall system. The leveling pad shall be built a minimum width of 12 inches and a minimum depth of 6 inches. The concrete on the leveling pad shall be cured a minimum of 12 hours before any of the wall system panels are placed.

2. Granular Base. Select granular material shall extend a minimum of four (4) inches from both the face and back of the selected concrete block and have a minimum depth of eight (8) inches. The following requirements shall apply to the granular base:

a. The minimum density shall be no less than 95 percent of maximum density, determined in accordance with AASHTO T 99.

b. The moisture content of the material prior to and during compaction shall be uniformly distributed throughout each layer. The placement moisture content shall be no lower than three percentage points less than the optimum moisture content and shall be no more than the optimum moisture content.

3. Basis of Payment.

a. Concrete Walls and Culverts. The concrete structures specified herein will be paid for at base price per cubic yard of concrete as per plan dimensions and will include all labor, equipment, materials, excavation, backfill, forms, reinforcement, except castings, as per drawings and specifications to complete the structure in place.

Special castings used in these structures will be paid for as provided in the contract documents or special provisions.

b. Mechanically Stabilized Earth Wall systems (MSE). The MSE wall systems shall be measured, complete and in place, to the nearest square foot and paid for at the contract unit price and will included all labor, equipment, materials, excavation and backfill. The measured quantity shall include all buried or partially buried concrete blocks. No direct

payment will be made for the excavation for both the leveling pad and the reinforced earth area as shown on the plans.

D. CONCRETE CULVERTS

1. Scope of Work. This work shall consist of providing concrete culverts, as designated on plans to the dimensions specified.

2. Materials.

   a. Concrete shall be Class "A" Portland Cement Concrete in accordance with the requirements of Chapter VII of these specification.

   b. Reinforcing steel shall consist of deformed bars of grade 40 steel conforming to the requirements of ASTM A615 or of wire fabric conforming to ASTM A185.

   c. Expansion joint fillers shall be of a non- extruding type conforming to ASTM D1751 and cut to the dimensions shown on the plans.

   d. Bedding Material. Material for bedding shall be crushed stone or crushed gravel conforming to the requirements of ASTM Standard C33, and having a gradation as follows:

	Sieve Size	% Passing
Passing	1/2"	100
Passing	3/8"	30 – 100
Passing	No. 4	0 – 5

3. Construction Methods.

   a. Forms. Forms shall be of wood, plywood, or any other suitable material, designed, constructed, braced, and maintained so that the finished concrete will be true to line, and elevation will conform to the required dimensions. They shall be designed to withstand the pressure of the concrete, the effect of vibration as the concrete is placed and all other loads incidental to the construction operations, without distortion or displacement. They shall be mortar tight. Oiling both inside and outside surfaces will be required to prevent warping, shrinkage or swelling.

   Forms shall be constructed and designed so that their removal can be effected without injury to the concrete and so that portions where surface finishing is required may be removed without disturbing forms that are to remain. Three-fourths (3/4)-inch chamfer strips shall be placed on all edges to be exposed. Dirt, chips, sawdust, nails, and other foreign matter shall be removed before any concrete is deposited therein.

   Tie rods, belts, and anchorages within the forms shall be constructed so as to permit their removal to a depth of at least one and one half (1 ½) inches from the face without

injury to the concrete. In case wire ties are used, upon removal of the forms, all projecting wire shall be cut back at least one half (1/2) inch from the face of all surfaces that will be exposed to view after the completion of the work and flush with the face of all concrete surfaces that will not be exposed to view. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest practical size.

b. Inlet and Outlet Pipe. Pipe or tile placed in the concrete for inlet or outlet connections shall extend through the concrete walls beyond the outside surfaces of the walls a sufficient distance to allow for connections. The pipe or tile shall be placed through the forms and poured in place.

c. Falsework. Falsework for concrete masonry construction shall be adequate to support and hold the forms true to lines, camber and grades shown on the plans. If requested by the Engineer, the contractor shall submit detailed plans for falsework, including the supporting design computations. The Engineer's acceptance of the plans will not relieve the contractor of the responsibility for obtaining satisfactory results. The falsework shall be constructed in general accordance with the submitted plans. Falsework and forms for single and multi-span concrete frames and for continuous concrete slab and girder-type bridges shall be provided for the full length of each continuous or monolithic unit and for the full width of the structure before starting concrete placement in that unit. The use of shims or blocking shall be held to a minimum. Jacks shall be placed at approved locations to secure and maintain the required camber. Means shall be provided by the contractor for accurately determining settlement of the falsework while the falsework is being loaded. The contractor shall correct for any settlement of forms or falsework during the concrete placing process.

d. Reinforcement.

1. Placement. Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with concrete Reinforcing Steel Institute's "Recommended Practice for Placing Reinforcing Bars," and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the top surface of the concrete (except where shown on the plans) and wooden supports, shall not be used.

   Placing bars on layers of fresh concrete as the work progresses, and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rusts, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved by the Engineer.

2. Splicing. Splicing of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least thirty (30) diameters, unless otherwise shown on the plans.

   Splicing space shall be accomplished by placing the bars in contact with each other and wiring them together.

   Welding of reinforcing steel or cutting with a cutting torch will not be permitted unless specifically authorized by the Engineer.

3. Bending Reinforcement. Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the American Concrete Institute.

   Bars shall not be bent or straightened in a manner which will injure the material. Bars with kinks or unspecified bends shall not be used.

4. Welded Wire Fabric. Welded wire fabric shall be spliced no less than two (2) meshes. It shall be lifted carefully into its specified position after the concrete is placed but still plastic.

e. Bedding. The subgrade for the structure shall be excavated a sufficient depth so as to provide space for at least four (4) inches of bedding material between the subgrade and the structure. Bedding material shall be placed and compacted to the proper elevation.

f. Placing Concrete. Concrete shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients.

   Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.

   Where a sequence for placing concrete is shown on the plans, no deviation will be permitted unless approved in writing by the Engineer.

   Where concrete is to be placed against hardened concrete, the hardened concrete shall be wetted immediately before placing the fresh concrete, and then vibrated sufficiently to ensure no voids.

   To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened or is contaminated by foreign materials shall not be deposited in the structure.

   Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and proceed upgrade unless otherwise permitted by the Engineer. Concrete

shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.

Concrete shall not be permitted to fall more than six (6) feet without the use of pipes or tremies. Pipes or tremies shall be at least six (6) inches in diameter, or the equivalent cross sectional area for rectangular sections. Concrete shall not be placed in horizontal members or sections until the concrete in the supporting vertical members or sections has been consolidated and a two- (2) hour period has elapsed to permit shrinkage to occur.

Concrete shall be thoroughly vibrated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Structural concrete, except slope paving steeper than one (1) inch per foot, such as spillway aprons and channel lining, and concrete placed under water, shall be consolidated by means of high frequency internal vibrators of a type, size, and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in good operating condition shall be available at the site of the structure in which more than twenty-five (25) cubic yards of concrete is to be placed.

g. Joints. The work shall be so prosecuted that construction joints will occur at designated places shown on the plans unless otherwise authorized by the Engineer. The contractor shall construct, in one continuous concrete placing operation, all work compromised between such joints. Joints shall be kept moist until adjacent concrete is placed.

All construction joints having a keyed, stepped, or roughened surface shall be cleaned prior to placement of the adjacent concrete as directed by the Engineer.

Three fourths (3/4) inch expansion and contraction joints for cast-in-place concrete structures shall be constructed at a minimum distance between joints of fifty (50) feet, and in no case shall exceed seventy five (75) feet. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

No direct payment will be made for furnishing and placing asphaltic paint, pre-molded asphaltic filler, or other types of joint separators. The cost, therefore, shall be included in the price bid for the item of work of which they are a part.

h. Cold Weather Requirements. Whenever the temperature of the surrounding air is below 40 degrees F within the 24-hour period after concrete operations, concrete placed in the forms shall have a temperature of between 50 degree and 90 degree F. All concrete shall be maintained at a temperature of no less than 50 degrees F for at least 72 hours or for as much time as is necessary to ensure proper curing of the concrete. The housing, covering, or other protection used in connection with curing shall remain in place and intact at least twenty-four (24) hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Contractor will be held responsible for any damage to concrete as a result of cold weather operations. No concrete will be placed on a bridge superstructure when the air temperature is less than 40 degrees F.

i. Finishing. The top surfaces of structures shall be struck off with a straight edge and finished with a wood or aluminum float. As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surfaces shall either be covered with a plastic sheet, burlap, or sprayed with white pigmented membrane curing compound conforming ASTM 309, type 2. Forms shall be removed between four (4) and twelve (12) hours after concrete placement and all exterior form ties shall be removed to a depth of one (1) inch below the surface, all fins caused by forms, joints, and other projections shall be removed, and all pockets cleaned and filled with mortar. All exposed surfaces shall then be wetted and hand rubbed with a rubber float using a sand and cement mixture to obtain a smooth and uniform texture as directed by the Engineer.

j. Backfilling. Structures which lie within the area to be paved, or within two (2) feet of the back of curb shall be backfilled with granular material meeting the requirements of bedding material specified hereinbefore. Backfill not within two (2) feet of the paving area may be clean earth. Bedding material shall be placed and thoroughly compacted. Earth backfill shall be placed in accordance with the requirements specified in Chapter VI o f these specifications for pipe backfilling.

k. Removal of Forms. Forms shall remain in place until, in the opinion of the Engineer, it is safe to remove them. On structures such as box culverts, forms shall not be removed until the concrete has attained a strength of 3,000 pounds per square inch. In determining the time for removal of forms, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the requirements for curing and finishing.

4. Method of Measurement.

a. Measurement of concrete culverts will be made to the nearest 1/10 cubic yard of concrete for each structure. No deductions will be made for space occupied by reinforcing steel, conduits or piles. Deductions will be made for space occupied by the tubes in voided slabs.

5. Basis of Payment.

a. The accepted quantity of concrete culverts, complete and in place, will be paid for at the contract unit price per cubic yard and will included all necessary labor, excavation, and materials for proper placement.

b. No direct payment will be made for incidental items necessary to complete the work unless specifically provided as a pay item in the contract documents. No direct payment will be made for concrete required to fill overbreak where footings or walls are cast against vertical faces of rock or shale excavation.

c. No direct payment will be made for furnishing and applying a surface sealer and all incidental work. Payment shall be considered completely covered by the contract unit price of concrete culverts.

Section 427.090. Traffic Control Facilities

A. TRAFFIC SIGNALS

1. Scope of Work. Refer to the most current edition of "Missouri Standard Specifications For Highway Construction", Division 900, Section 902 for all work pertaining to signal installation and/or modification.

B. STREET SIGNING

1. Scope of Work. This work shall consist of furnishing and installing street signs as shown on the plans are as directed by the City.

2. Material. All signs shall be in accordance with the latest edition of the "Manual on Uniform Traffic Control Devices", (MUTCD). Any signs not detailed on the plans shall be in accordance with the "Standard Highway Signs" by the U.S. Department of Transportation, Federal Highway Administration.

   a. Reflective Sheeting. Retroreflective sheeting shall be in accordance with latest versions or ASTM D 4956 and AASHTO M 268, except as noted herein. Color and luminance values for all types of reflective sheeting shall be in accordance with ASTM D 4956. Retroreflective sheeting shall have sufficient adhesion, strength and flexibility such that the sheeting can be handled, processed and applied according to the manufacturer's recommendations without appreciable stretching, tearing, cracking or other damage. Adhesive performance for retroreflective sheeting shall be in accordance with ASTM D 4956. The sheeting surface shall be in condition to be readily screen processed and compatible with transparent overlay films, plus recommended transparent and opaque screen process colors. The retroreflective sheeting manufacturer shall furnish information as to the type of solvent or solvents that may be used to clean the surface of the sheeting without detrimental loss of performance and durability. Retroreflective sheeting having a datum mark on the surface shall be oriented vertically. ASTM D 4956 Type IX, XI or AASHTO M 268 Type C or D retroreflective sheeting applied as legend

and border for specific signing applications, without a datum mark on the surface of the sheeting, shall be evaluated for rotational sensitivity per AASHTO M 268, Section 3.3. Retroreflective sheeting products that do not meet the rotational sensitivity requirements of Section 3.3 shall follow guidelines detailed in AASHTO M 268 Section 3.3.1 and fabricated per AASHTO M 268 Section 3.3.2. ASTM D 4956 Type I, Class 1 retroreflective sheeting shall be enclosed lens glass-bead or prismatic sheeting.

Background sheeting applied to flat sheet and extruded panel signs shall be in accordance with ASTM D 4956 Type IV, Class 1. All yellow, orange and red sheeted signs shall be fabricated with ASTM D 4956 Type IX, XI or AASHTO M 268 Type C or D fluorescent yellow, fluorescent orange and prismatic red sheeting respectively. Retroreflective sheeting shall be high intensity that is an unmetallized micro prismatic reflective material.

b. Manufacturer and Brand Name Approval. The manufacturer shall make available, upon request, NTPEP test results from all test decks, and certification to Construction and Materials, showing reflective material is in accordance with ASTM D 4956 specification. In addition, the manufacture shall, upon request, submit samples representing the retroreflective sheeting tested by NTPEP, and with compatible inks. These samples shall be accompanied by a product data sheet, an MSDS, technical bulletins on sign fabrication and any special fabrication instructions relative to the retroreflective sheeting submitted. Samples of retroreflective sheeting shall be 10 x 10 inches and applied to an aluminum substrate.

c. Types of Characters. Letters, numerals, arrows, sysmbols, borders and other features of the sign message shall be of the type, size and series shown on the plans, or as specified by the engineer, providing all MUTCD criteria have been met.

d. Square Steel Post. All sign post are to be galvanized two (2) inch square steel perforated post with break-away sleeves and shall meet ASTM A 53, Grade B or ASTM A 500, Grade B specifications.

3. Construction Method.

a. Post Length. Post lengths shown on the plans for ground-mounted signs are for bidding purposes only. The contractor shall be responsible for determining post lengths to provide the vertical clearances shown on the plans or defined in the MUTCD. Field cutting of posts will be permitted.

b. Post Alignment. Sign post shall be vertical. Any post bent or otherwise damaged to the extent that the post is considered unfit for use shall be removed and replaced with an acceptable post at the contractor's expense.

c. Surfaces. Galvanized material shall be handled to avoid damage to the surfaces. Any material on which the galvanizing has been bruised or broken may be rejected.

d. Delivery and Storage. Signs delivered on site shall be stored in a manner meeting the approval of the Engineer. Any sign damaged, discolored or defaced during transportation, storage or erection may be rejected.

4. Method of Measurement.

a. Measurement of sign areas will be made to the nearest 1/10 square foot for each sign and to the nearest square foot for the total. The area of each sign will be that of the smallest rectangular, triangular or trapezoidal shape that will encompass the sign panel.

b. Measurement of perforated square steel post will be made to the nearest linear foot for each post, as shown on the plans.

5. Basis of Payment.

a. Signs will be paid for at the unit price per square foot of signs, complete and in place, and will cover all labor, equipment, and material necessary for proper erection.

b. Perforated Square Steel Post will be paid for at the contract unit price per linear foot of post, complete and in-place, and will cover all labor, excavation, footings, break-away sleeves, and materials necessary for proper placement.

Section 427.100. Landscaping

A. SUMMARY

This section includes criteria for seeding, sodding and tree planting. All disturbed areas shall be seeded and mulched except for sodded areas, surfaced areas, and solid rock. Disturbed areas outside of authorized construction limits shall be seeded and mulched, or sodded at the contractor's expense.

B. MATERIALS

1. SEED

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

b. Seed Species: State-certified seed of grass species shall be used, proportioned by weight as follows:

- 20% Adventure Fescue
- 20% Jaguar IV Fescue
- 20% Olympic Fescue
- 20% Arid Fescue

- 20% Regal Perennial

c. Certification of seed mixture shall be submitted.

2. TOPSOIL

a. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

b. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

c. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

3. INORGANIC SOIL AMENDMENTS

a. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

b. Perlite: Horticultural perlite, soil amendment grade.

c. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

d. Sand: Clean, washed, natural or manufactured, free of toxic materials.

4. ORGANIC SOIL AMENDMENTS

a. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

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

5. FERTILIZER

a. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic

sources of urea formaldehyde, phosphorous, and potassium in the following composition:

b. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

c. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

d. Composition: 12 percent nitrogen, 12 percent phosphoric acid, and 10 percent potash, by weight.

6. MULCHES

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

b. Mulch for Trees: Mulch shall be composted yard waste or wood chips, two inches (2") or less in size.

7. SOD

a. Sod: Sod shall be the same type as removed or damaged, shall be best quality, not more than two years old and meeting the following standards:

1. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 inch, plus or minus 1/4 inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

2. Pad Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 inch on width and plus or minus 5 percent on length. Broken pads and torn or uneven ends will not be acceptable.

3. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and should retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

4. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) will adversely affect its survival. No dry or frozen sod shall be used.

5. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 1 to 2-1/2 inches.

6. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (uncompressed).

7. Diseases, Nematodes, and Insects: Sod shall be reasonably free of diseases, nematodes, and soil-borne insects.

8. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than 5 such plants are found per 100 square feet of area. Sod will not be acceptable if it contains any of the following weeds: quack grass, Johnson grass, poison ivy, nutsedge, nimblewill, Canada thistle, bind weed, wild garlic, ground ivy, perennial sorrel, bromegrass, bentgrass, and Bermuda grass.

8. TREES

Trees shall be 1.5 to 2.5 inch caliper measured 18 inches above ground line. Number, species, and location of trees shall be as shown on the plans. For trees replacing those removed during construction, new trees shall be the same type as those removed, shall be approximately the same size and dimensions, and shall be nursery grown. Trees shall be wrapped with standard nursery paper from the ground line to the first branches above the ground line and balled with burlap wrapping. Fertilizer shall not be used in or around hole. Mulch shall be composted yard waste or wood chips, two (2) inches or less in size, placed around the tree.

C. PRELIMINARY CLEANUP AND PREPARATION

1. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

3. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

4. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

5. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

6. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

D. SEEDING

1. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

2. Sow seed at a total rate of 7 to 8 lb./1000 square feet or 350 lb./acre.

3. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

4. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

5. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

E. SODDING

1. The sodbed shall have a uniform surface free from rills, washes, and depressions and shall conform to the finished grade and cross section as shown on the plans. The area to be sodded shall be fertilized with the specific mixture by spreading evenly at the rate of twelve (12) pounds per one thousand (1,000) square feet of area. Fertilizer will not be required where strip sodding is designated. The bed shall be in a firm but uncompacted condition with a relatively fine texture at the time of sodding. No sod shall be placed until the sodbed is approved by the Engineer. Delivery of sod shall be timed so that sod will be transplanted within a period of 36 hours unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer prior to its installation. Sod shall be moist and shall be placed on a moist earth bed. Sod strips shall be laid along contour lines, by hand, commencing at the base of the area to be sodded and working upward. The transverse joints of sod strips shall be broken, and the sod carefully laid to produce tight joints. Care shall be exercised to ensure that the sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause air drying of the roots. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by use of a lawn roller or tamper. On 3:1 slopes, or steeper, the sod shall be pegged with wood pegs approximately one half (1/2) inch X twelve (12) inches driven into the ground, leaving about one half (1/2) inch of the peg above the sod, and spaced not more than two (2) feet apart. Pegging of sod shall be done immediately after the sod has been firmed. When sodding is completed, the sodded areas shall be cleared of loose sod, excess soil, or other foreign material, and a thin application of topsoil shall be scattered over the sod as a top dressing. The quantity of topsoil shall be such as will cause no smothering of the grass. It shall then be thoroughly watered to a depth sufficient that underside of the new sod pad and the soil immediately below the sod are thoroughly wet.

2. In areas designated for Strip Sodding, the sod strips shall be laid in a horizontal line with tight transverse joints and a spacing of eighteen (18) inches between strips. The area where the sod strips are to be laid shall be trenched to a depth sufficient to ensure complete

embedment of the sod. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by the use of tampers or other approved methods. A thin application of topsoil shall be scattered over the sod as a top dressing, and the areas thoroughly moistened.

F. LAWN MAINTENANCE

1. Protection: Seeded and sodded areas shall be protected against traffic. If necessary, barricades or warning signs shall be erected. Such protective devices shall be maintained until final acceptance of the project.

2. Maintenance: All seeded and sodded areas shall be maintained by the Contractor until acceptance, but in no case shall maintenance be for less than 30 days following completion of all seeding, mulching, and sodding operations. Maintenance shall include watering, mowing, reseeding, repair of erosion damage, maintenance of mulch, fertilizing, weeding and removal of litter.

3. Replanting: Prior to the end of the maintenance period, seeded and sodded areas that show signs of substantial desiccation, as evident by a loss of color and a distinct yellowing or where no germination is evident, shall be considered as failed and shall be reseeded or resodded and continue to be reseeded or resodded until an acceptable cover is obtained. Replanting operations shall be as originally specified.

4. Maintenance of Grades: Original grades of grass areas shall be maintained after commencement of planting operations and during the maintenance period. Any damage to the finished surface from construction operations shall be repaired within a reasonable time. In the event erosion occurs from watering operations or rainfall, such damage shall be repaired within a reasonable time. Ruts, ridges, tracks, and other surface irregularities shall be corrected, and reseeded where required.

5. Maintenance of Mulch: Mulched areas shall be maintained until covered with growing grass seedlings. Mulch material that has been removed from the site by wind or other causes shall be replaced and secured.

6. Mowing: All sodded areas shall be mowed at least once for acceptance.

   Not more than 1/3 of the grass lead shall be removed by the initial cutting or subsequent cuttings. Height shall be maintained at 2-1/2 inches.

   Mowing equipment shall be rotary type in good operating condition, well adjusted, and with sharp blades. Extra care shall be taken when mowing around trees and shrubs to prevent bark damage. Any trees and shrubs with damaged bark as a result of maintenance operations shall be replaced by the Contractor at his expense. Clippings shall be blown off of private driveways and parking lots.

Prior to any mowing operations, all debris that would interfere with mowing shall be collected and removed. The debris includes, but shall not be limited to, paper and cardboard, cans, bottles, and any other wastes that detract from the general appearance of any area of the site.

7. Satisfactory Lawn: At end of maintenance period, a healthy, uniform, close stand of grass shall be established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any and bare spots not exceeding 5 by 5 inches. Specified materials shall be used to reestablish lawns that do not comply with requirements and maintenance shall be continued until lawns are satisfactory.

G. TREE PLANTING

Holes for the balled trees shall be a minimum of two (2) feet greater in diameter than the balled tree and six (6) inches deeper than the depth of the ball. The hole shall be filled with water prior to planting and drained before soil is backfilled around new tree. Fifty percent topsoil and 50 percent peat moss shall be used to fill around and under the tree and shall be free of rocks greater than one-half inch diameter and tamped firmly in place. It is important to note the soil-stained ring on the base of the tree trunk be at ground level when planted. Stability shall be provided using stakes and wires. Two stakes, equally spaced and opposite each other, shall be installed two (2) feet from the tree. Appropriate wire shall be affixed around the tree and to the stakes four (4) feet above and parallel to the ground, with protection so as not to injure or cut the tree. Mulch shall be placed over the entire excavated area for the tree to a depth of six (6) inches. All disturbed areas around the trees shall be mulched. Disturbed areas outside of authorized construction limits shall be seeded and mulched or sodded as determined by the Engineer, at the contractor's expense.

H. SCHEDULE PROVISIONS

All landscaping work shall be performed within acceptable planting seasons. For work to be performed outside of the guidelines listed below, approval shall be obtained from the Director of Public Works:

1. Seed – Seeding shall not be placed from June 1 to September 1 nor from November 1 to March 15.

2. Sod – Sod shall not be placed during a drought nor from June 1 to September 1.

3. Trees – Trees shall not be planted from May 15 to November 1.

If a project is completed except landscaping components, the schedule for liquidated damages will be adjusted based on the allowing planting schedule.

I. WAIVER

Some aspects of this Landscaping Section may be waived by the Engineer if the property which is the subject of the waiver request is owned by the same party that is contracting to install the water main. Such request must be made in writing and state that the owner of the property is installing the main and will accept all responsibility for all of the requirements herein being requested to be waived. The request will also state that the owner will be solely responsible for and hold harmless the City of Farmington for any damage to the owners or any surrounding property due to the contractor's lack of compliance with those provisions being waived.

J. BASIS OF PAYMENT

1. Seeding will be paid for on a unit price per acre basis, with measurement made to the nearest one-tenth (1/10) acre. The unit price is to include all costs associated with the seeding, soil amendments, fertilizer, mulch, and maintenance of the seeded area until the job is accepted by the Engineer.

2. Sodding will be paid for on a unit price per square yard basis. Measurement will be made to the nearest square yard of approved sodded surface area, including the area between strips for strip sodding. The unit price is to include all costs associated with subgrade preparation, sodding, and maintenance of the sodded area until the job is accepted by the Engineer.

3. Trees will be paid for based on the unit price bid for each tree. The unit price will include excavation, planting, removal of spoils, watering, soil replacement, staking and mulching. The unit price will also include a one-year guarantee for replacement in the event the tree dies.

SECTION 2. That the Municipal Code of the City of Farmington, Title VII: Utilities, Chapter 705 Waterworks System, Article II, Extension of City Water Mains, Section 705.070 Design Standards, and Section 705.080 Pipe Size are hereby deleted.

SECTION 3. That the Municipal Code of the City of Farmington, Title IV: Land Use, Table H: Street Cross Section Standards is hereby deleted.

SECTION 4. That the Municipal Code of the City of Farmington, Title IV: Land Use, Title IV Attachment 8, Table H: Street Cross Section Standards, Title IV Attachment 8:3, Section Width Curb, and Title IV Attachment 10, Table J, Design Characteristics of Street Pavement is hereby deleted.

SECTION 5. The officers, agents and employees of the City are hereby authorized and directed to execute all documents and take such necessary steps as they deem necessary and advisable in order to carry out and perform the purpose of this Ordinance.

SECTION 6. The sections of this Ordinance shall be severable. If any section of this Ordinance is found by a court of competent jurisdiction to be invalid, the remaining sections shall remain valid, unless the court finds that: (a) the valid sections are so essential to and inseparably

connected with and dependent upon the void section that it cannot be presumed that the City Council has or would have enacted the valid sections without the void ones; and (b) the valid sections, standing alone, are incomplete and are incapable of being executed in accordance with the legislative intent.

SECTION 7. This Ordinance shall be in full force and effect from and after its date of passage and approval.

DULY READ AND PASSED THIS 24TH DAY OF JUNE, 2024.

Larry D. Forsythe, Mayor

ATTEST:

Casey Moore, City Clerk

Approved this 24 day of June, 2024.

Larry D. Forsythe, Mayor

ATTEST:

Casey Moore, City Clerk

APPROVED AS TO FORM:

R. Scott Reid, City Counselor