TECHNICAL SPECIFICATIONS

FOR

PROPOSED SANITARY WASTEWATER & TREATMENT FACILITIES

FOR

NORTHERN HEIGHTS ESTATES SUBDIVISION

FOR

4J LAND & CATTLE COMPANY
P.O. BOX 308
WAYNESVILLE, MISSOURI 65583

BY

ANDERSON & ASSOCIATES
Consulting Engineers, LLC

1511 Watts Drive ❖ P.O. Box 806
Rolla, Missouri 65402-0806

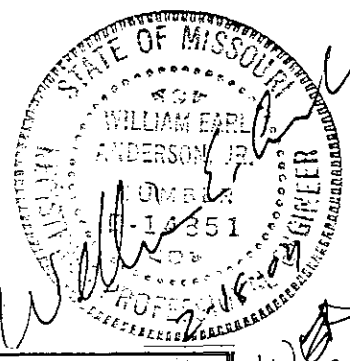

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EXHIBIT A

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The drawings referred to and accompanying these specifications consist of the following sheets:

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GENERAL CONDITIONS

GC-1 NOTICE

a) The General Conditions, Special Conditions, all other sections of the specifications, and all other herein bound documents are part of this section and of the Contract. Before submitting Proposals, bidders should read all the above mentioned documents and familiarize themselves with all requirements of same. Submission of Proposal implies that the bidder is fully conversant with all requirements of all said documents. No claim for additional compensation will be considered or paid on account of the Contractor's neglect or failure to be so informed.

b) Before submitting Proposals, bidders should visit the site(s) of the proposed work, verify all site conditions and also conditions under which said work must be conducted. Submission of Proposal implies that the bidder is fully conversant with all such conditions. No claim for additional compensation will be considered or paid on account of the Contractor's neglect or failure to be so informed.

GC-2 DEFINITIONS

a) Acceptance: The formal written acceptance by the Engineer of the Contract which has been completed in all aspects in accordance with the Drawings, Specifications and all Contract Documents and any modifications thereof previously approved.

b) Act of God: An earthquake, flood, cyclone, or other cataclysmic phenomenon of nature. Rain, wind, or other natural phenomenon of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the Contractor for damages to the work resulting therefrom.

c) "Approved", "Proper", "As Directed", "As Instructed", and "As Selected": As used throughout these specifications and other Contract Documents mean the approvals, directions, instructions, and selections by the Engineer are required, unless otherwise clearly stated.

d) Bidder: Any individual, partnership, corporation, or combination thereof, submitting a proposal for the performance of the Contract, acting directly or through a duly authorized representative.

e) Contract: The agreement covering the performance of the work described in the Contract Documents including all supplemental agreements thereto and all general and special provisions pertaining to the work or materials thereof.

f) Contract Documents: The Contract Documents consist of the Notice to Contractors, Instruction to Bidders, Bid Proposal, Contract Agreement, Bid Bond Performance Bond, General Conditions, Special Conditions, Detailed Specification Requirements, Drawings, and any addenda thereto; also any supplemental drawings by the Engineer, those working Drawings submitted by the Contractor as approved by the Engineer, including any manufacturer's Drawings of equipment for permanent installation in this project; also any and all supplemental agreements amending or extending the work contemplated and which may be required to complete the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations, amendments or extensions of the Contract and include contract change orders. All these documents are complementary to, and explanatory of each other, and each and every one of these documents is a part of the Contract.

g) Contractor: The person, partnership, corporation, or combination thereof, private or municipal, or his or their lawful representatives, who have entered into a contract with the Owner.

h) Contract Time: The time allowed for the completion of the work computed in consecutive calendar days from the date of notice to the Contractor to commence work.

i) Days: Calendar days, unless otherwise designated.

j) Drawings: All drawings listed in the Index of Drawings and any addenda thereto, all supplemental drawings, working drawings and revisions to same, or exact reproductions thereof, as prepared or approved by the Engineer and officially given to the Contractor.

k) Engineer: Anderson and Associates, Consulting Engineers, acting either directly or through properly authorized representatives, such representatives acting within the scope of the responsibilities and authority delegated to them. Mention is made of them throughout the Contract Documents as though each is of singular number and masculine gender.

l) Inspector: Any authorized representative of the Engineer or Owner assigned to make any and all necessary inspections of the work and materials furnished by the Contractor, and his authority definitely restricted to these functions.

m) Owner: The term "Owner", as used throughout these Specifications means: government bodies, including municipalities, corporations, partnerships, or individuals designated as Owner in the Agreement and throughout the Contract Documents.

n) Notice: The provision in any of the Contract Documents regarding the giving of any notice implies that the notice has been given, as to the Owner: when written notice has been delivered to the Engineer, or has been placed in the United States' Mail addressed to the Owner's chief executive officer; as to the Contractor: when written notice has been delivered to the Contractor's chief at the project site, or by placing such written notice in the United States' Mail addressed to the Contractor at the place stated in the papers prepared by him to accompany his proposal as the address of his permanent place of business; as to the Surety on the Performance Bond: when a written notice is placed in the United States' Mail addressed to the Surety at its home office, or to its agent or agents who executed such Performance Bond on behalf of said Surety.

o) Performance Bond: The approved form of security furnished by the Contractor and his Surety as a guaranty of good faith on the part of the Contractor to execute the work in accordance with the terms of the Contract.

p) Proposal: The offer of a Bidder to perform the work described by the Contract Documents when made out and submitted on the prescribed Proposal Form, properly signed and guaranteed.

q) Proposal Guaranty: The cashier's check or Bidder's Bond accompanying the Proposal submitted by the Bidder, as a guaranty that the Bidder will enter into a Contract with the Owner for the construction of the work, if the Contract is awarded to him.

r) Provide: The word "provide" as used throughout these Specifications and other Contract Documents, means that the Contractor shall provide the required labor, services, equipment, tools, transportation; and, the Contractor shall also provide the specified materials, accessories, work, equipment, furnishings, transportation, and other required items in place, complete, unless definitely specified otherwise.

s) Site of the Work: The area to be occupied by the project and all adjacent areas and

other related areas occupied or used by the Contractor or his subcontractors during the performance of the work, including areas for the production, procurement, storage and disposal of earthwork, concrete and paving materials, and similar materials.

t) Specifications: The Specifications shall include the Invitation to Bid, Instruction to Bidders, Bid Proposal, Contract Agreement, Bid Bond, Performance Bond, General Conditions, Special Conditions and the Detailed Specification Requirements, including all modifications thereof and all addenda thereto.

u) Subcontractor: Any person, firm, or corporation with a direct contract with the Contractor who acts for or in behalf of the Contractor in executing any part of the Contract, including one who furnishes material worked to a special design according to the Drawings or Specifications of this work, but not including one who merely furnishes material not so worked.

v) Surety: The person or persons, firm or firms, or corporation or corporations which execute the Contractor's Bid Bond and/or Performance Bond and/or Labor and Materials Payment Bond.

w) The Work: All the facilities specified, indicated, shown or contemplated by the Contract as comprising and necessary for the completion of the project, including any portions of such facilities furnished to the Contractor by the Owner or the Engineer, and, except as otherwise expressly provided in the Specifications, the provision and furnishing by the Contractor of all materials, equipment, labor, methods, processes, construction and manufacturing materials and equipment, tools, plants, supplies, power, water, transportation, and other things necessary to complete such facilities in accordance with the Contract.

x) Work: As used throughout the Contract Documents, the term "work" of the Contractor or Subcontractor, implies the furnishing of materials or labor or both.

y) Reasonable Time: The words "reasonable time", as used throughout the Contract Documents, mean: " not over ten (10) days from receipt of notice".

z) Common Usage: Words having usual, customary, well known trade or technical meanings imply such meanings as used throughout the Contract Documents.

GC-3 ABBREVIATIONS

Certain abbreviations, as used throughout these Specifications and other Contract Documents, mean:

AASHTO	-	American Association of State Highway & Transportation Officials
ACI	-	American Concrete Institute
ADA	-	Americans with Disabilities Act
AIA	-	American Institute of Architects
AISI	-	American Iron and Steel Institute
AISC	-	American Institute of Steel Corporation
ASA	-	American Standards Association (Now USASI - United States of America Standards Institute)
ASHRAE	-	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWS	-	American Welding Society
AWPA	-	American Wood Preservers' Association

IEEE	-	Institute of Electrical and Electronics Engineers
NBFU	-	National Board of Fire Underwriters
NCPI	-	National Clay Pipe Institute
NEC	-	The National Electrical Code
NEMA	-	The National Electrical Manufacturers' Association
NFPA	-	National Fire Protection Association
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
UL	-	Underwriter's Laboratories
USAS	-	United States of America Standards Institute (Formerly ASA-American Standards Association)

GC-4 THE CONTRACT DOCUMENTS

a) The Agreement, the General Conditions, the Special Conditions, the Drawings, the Specifications, including all addenda issued prior to the execution of the Agreement, taken together form the Contract.

b) The Contractor and the Owner shall sign the Contract Documents in not less than duplicate; in case the above fail to sign the General Conditions, Special Conditions, Drawings, or Specifications, the Engineer will identify them.

c) The work in this Contract includes the furnishings of all materials, accessories, equipment, expendable equipment, tools, utilities, transportation, services, labor, and other items of work reasonably incidental thereto, and performance of all operations, as required to completely execute all work for this project, and to outline items or work which cannot be readily shown on the Drawings; and to further indicate types and quality. The Drawings and Specifications are cooperative and contiguous; items and work mentioned or indicated in one and not the other shall be included, provided, supplied, and performed as though fully covered by both. It is not intended that work not specified in or inferable from any section, class, or trade of the Specifications shall be provided unless shown on the Drawings.

d) Unless otherwise definitely noted on Drawings or so specified in these Specifications, the Contractor shall provide all work for this project in place complete.

e) For convenience of reference and to facilitate awarding of the Contract, these Specifications are separated into titled sections. Such separated shall not operate to make the Engineer an arbiter, to establish limits to the Contract between the Contractor and subcontractor. Nothing in the Contract Documents shall create any contractural relationship between the Owner and any Subcontractor.

f) In case of apparent disagreements in the Drawings or Specifications, either within themselves or with each other, Contractors shall estimate on and provide the greater quantity or better quality, unless otherwise directed by the Engineer.

GC-5 DRAWINGS, SPECIFICATIONS, AND INSTRUCTIONS

a) All work for this project shall be executed by the Contractor in accordance with all requirements of the Drawings, Specifications, Contract Documents and such additional instructions, detail Drawings or otherwise, furnished (reasonable promptly) by the Engineer for the proper execution of such work. Develop all detail Drawings properly, consistently and correctly from the Contract Documents. The Contractor shall not execute work without the proper Drawings and interpretation thereof. Figured dimensions shall have preference over scale measurements and

large scale Drawings over small scale Drawings.

b) All addenda, modifications, and amendments to the Drawings and Specifications, supersede all contrary or conflicting information on or in same.

c) If either the Engineer or the Contractor so requests, they may jointly set up a schedule establishing dates on which the detailed Drawings are required. The Engineer will furnish the Drawings on the established dates.

d) Immediately after award of Contract, the Contractor shall submit to the Engineer a progress schedule, fixing dates for the manufacture, installation, and completion of the entire project. The Contractor shall adhere strictly to the progress schedule, as approved by the Engineer.

e) Unless otherwise provided or so specified in the Contract Documents, the Engineer will furnish gratis to the Contractor, ten (10) copies of Drawings he may require for execution of the work.

f) The Contractor shall keep on the site of work, available to the Engineer, one (1) complete stamped and approved set (in good condition) of all Drawings and Specifications.

g) All Drawings, Specifications, and copies of same furnished by the Engineer are and remain his property. They shall not be used on other work but shall be returned to him upon completion of the work on this project.

GC-6 OWNERSHIP OF DOCUMENTS

All Drawings, Specifications, and copies thereof furnished by the Engineer are his property. They are not to be used on other work, and with the exception of the Contract Set, are to be returned to him on request, at the completion of the work.

GC-7 CONTRACTOR'S WORKING OR SHOP DRAWINGS

a) The Contract Drawings shall be supplemented by the Contractor with working Drawings as may be required for the prosecution of the work and approval of equipment. Working Drawings include shop detail Drawings, fabrication Drawings, erection Drawings, reinforcing bar placing Drawings, false-work and form-work Drawings, pipe layouts and similar classes of Drawings, which shall be approved by the Engineer before any work involving these Drawings is performed. No change shall be made by the Contractor in any working Drawing after it has been approved by the Engineer.

b) Working Drawings shall be submitted to the Engineer for approval before commencing work and in ample time to permit the satisfactory process of the work.

c) The sequence of submission of working Drawings shall be such that all information is available to the Engineer for review of each Drawing as it is received. One (1) transparent print and two (2) prints of each working Drawing shall be submitted. One (1) transparent print of each Drawing will be returned to the Contractor marked "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", or, "Rejected -- See Remarks", within twenty (20) calendar days after receipt. The Contractor shall make necessary corrections and revisions to Drawings returned marked "Make Corrections Noted", "Amend and Resubmit", or, "Rejected -- See Remarks", and shall resubmit the Drawings in the same routing as before within twenty (20) calendar days after

receipt. Responsibility will be upon the Contractor to furnish Drawings in sufficient time for approval action, including resubmittal, without delaying construction.

d) All working Drawings, shop Drawings, schedules, and illustrations shall be submitted through the Contractor and not directly by Subcontractors, suppliers, and manufacturers. The Contractor shall be responsible for the coordination of all shop drawings required for the work.

e) The Contractor shall, at his own expense, make such changes in the above Drawings as may be found necessary upon inspection by the Engineer to make the same conform to the Specifications or to the layout. Prior to approval of any such Drawings, any work which the Contractor may do on the equipment covered by the same shall be at his own risk, as the Owner will not be responsible for any expense incurred by the Contractor in changing equipment to make the same conform to the Drawings as finally approved.

f) The Contractor shall prepare all working, shop, erection, and equipment Drawings at proper scale, full dimension and showing in detail the design, construction, finishes, metal gauges, operating devices (if any), anchorage, installation requirements, and all other pertinent information required for complete fabrication, assembly installation of all the required work.

g) The Contractor is responsible for the accuracy of all dimensions and for all materials and their conformity to the Contract Documents and the Contract. He shall check (promptly) all shop Drawings and other data, and note corrections on same prior to their submittal to the Engineer.

h) When submitting shop Drawings, the Contractor shall mention in his letter of transmittal, proposed deviations (if any) from Drawings and Specifications requirements.

i) Working Drawings will be subject to approval insofar as the details affect the character of the finished work, but details of design will be left to the Contractor who shall be responsible for the successful construction of the work. It is expressly understood, however, that approval of the Contractor's working Drawings shall not relieve the Contractor of any responsibility for accuracy of dimensions and details, or for mutually agreed that the Contractor shall be responsible for agreement and conformity of his working Drawings with the Contract Drawings and Specifications.

j) In the case of minor equipment for which Drawings may not be required, the Contractor shall furnish to the Engineer a tabulated list, from time to time, showing the name of the manufacturer and the catalog number of the type of equipment proposed, together with such prints, dimensions, specifications, samples, or other data as may be required to permit intelligent judgement of the acceptability of the equipment proposed.

k) Upon approval of the above Drawings, lists, prints, samples, and other data, the same shall become a part of the Contract and the equipment furnished shall be in conformance with the same, provided that the approval of the above Drawings, lists, prints, specifications, samples, or other data shall in no way release the Contractor from the responsibility for the proper fulfillment by any equipment of the requirements of the Contract and of the purpose for which said equipment is installed nor from his liability to replace the same should it prove defective.

l) The Contractor shall provide additional copies of shop Drawings when requested by the Engineer.

m) The Contractor shall keep on site of the work at all times a complete, up-to-date, stamped, approved set of shop drawings available to the Engineer.

n) The cost of furnishing all working Drawings shall be included in the Contract Prices to which the Drawings are pertinent.

GC-8 CONFORMITY WITH DRAWINGS AND ALLOWABLE DEVIATIONS

Finished work in all cases shall conform with the lines, grades, cross-sections and dimensions shown on the approved Drawings furnished by the Engineer. Deviations from the Drawings as may be required by the exigencies of construction will be determined by the Engineer.

GC-9 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

Should it appear that the work to be done or any part of the matters relative thereto are not sufficiently detailed or explained in the Drawings or Specifications, the Contract shall apply to the Engineer for such further explanations as may be necessary and shall conform to them as part of Contract. Any questions regarding the true meaning of the Drawings or Specifications shall be directed to, and decided by the Engineer.

Whenever reference is made to a specification of ASTM, AWWA, or any other authority and the number accompanying the specification representing the year of its acceptance or adoption is omitted, the reference shall mean the specification in effect on the date of the Invitation Bid.

GC-10 ENGINEER'S STATUS

a) The Engineer is the Owner's representative during the construction period, and he shall observe the work in progress on behalf of the Owner. The Engineer has authority to act on the Owner's behalf only to the extent stipulated in the Contract Documents or otherwise by Owner's signed authority, which shall be shown to the Contractor. He has authority to stop the work whenever, in his opinion, it is necessary to do so in order to ensure proper agreement with the Plans and Specifications. The Engineer is the interpreter of the conditions of the Contract and the judge of its performance, and shall side with neither the Owner nor the contract, but shall exercise his powers under the Contract to enforce its faithful performance by both.

b) The Engineer shall render decisions on all claims of the Owner or Contractor, and on all other materials pertaining to the execution and progress of the work or interpretations of the Contract Documents, within ten (10) days after his receipt of written notice of same.

c) The decisions of the Engineer (subject to arbitration as specified in Article GC-11) shall be final, and the signing of the Contract implies the Contractor's agreement to accept the Engineer's decision as final in all such matters as require architectural and engineering decisions, such as quality of workmanship, suitability of materials for work, performance of equipment, fulfillment of guarantees thereon, and artistic effect.

d) In case the Engineer does not render a decision within ten (10) days after both parties have presented their evidence, either party may then demand arbitration.

e) The Engineer's failure to detect imperfections in the work or materials, or failure to notify the Contractor when to start, cease and to resume work shall in no way operate as a waiver of the Owner's rights to the specified standard of workmanship and materials and to efficient and prompt conduct (by the Contractor) of the work.

GC-11 ARBITRATION

a) All disputes, claims, or questions subject to arbitration under this Contract may be submitted to arbitration upon written notice of either party to the Contract and a copy of same filed with the Engineer. The demand for arbitration shall be made within a reasonable time after the dispute has arisen and shall not be made later than the time of final payment unless otherwise expressly stipulated in the Contract. When arbitration is demanded, the Owner and the Contractor shall each appoint an arbitrator, and the two thus appointed shall appoint a third arbitrator. If the first two arbitrators cannot agree upon a third within thirty (30) days from the date of their own appointment, the third arbitrator shall be appointed by the circuit judge having jurisdiction in the county within which the work is being performed. No person with a financial interest in the subject under arbitration is eligible to act as arbitrator.

b) The Contractor shall not cause a delay of the work during any arbitration proceedings, except by signed agreement with the Owner. It is hereby mutually agreed that the arbitrators' decision shall be a condition precedent to any right of legal action that either party may have against the other.

c) The arbitrators may award to the party whose contention is sustained such sums as they or a majority of them shall deem proper to compensate him for the time and expense incident to the proceedings and, if the arbitration was demanded without reasonable cause, they may also award damage for delay.

1. Judgement (under prevailing arbitration law) upon the award rendered may be entered in the court of the forum, State or Federal, having jurisdiction.

d) The arbitrators may engage experts to act in an advisory capacity, but without votes. The arbitrators shall fix their own compensation, unless otherwise provided by agreement, and shall assess the costs and charges of the proceedings upon either or both parties.

GC-12 INSPECTION

a) The Owner, the Engineer, and his representative shall have access at all times to the work whenever it is in progress or in preparation for the purpose of inspection. The Contractor shall provide proper, adequate facilities for such inspection.

b) If any work be covered up without approval or permission of the Engineer, it shall if directed by him, be uncovered for examination at the Contractor's expense and without extra cost to the Owner.

c) The Engineer may order re-examination of questioned work; if so ordered, the Contractor shall uncover same. If uncovered work conforms to requirements of the Contract Documents, the Owner shall pay the cost of re-examination and replacement. If questioned work does not conform to requirements of the Contract Documents, the Contractor shall pay the cost, including cost of replacing defective work, without extra cost to the Owner.

d) When the Contractor has completed the work in this Contract, the Owner, the Engineer, or his representatives, will make a final inspection of the work to determine its conformity to the Drawings, Specifications, and other Contract Documents. The Contractor shall provide (at his own expense and without cost to the Owner) all equipment and assistance necessary for final inspection, including all tests specified or required by law.

e) The presence or absence of the Engineer or his representatives during the performance of the work shall not relieve the Contractor of any of his obligations to fulfill the Contract as prescribed.

GC-13 SUPERINTENDENCE

a) The Contractor shall keep on his work during its progress a competent superintendent and any necessary assistants, all satisfactory to the Engineer. The superintendent shall not be changed except with consent of the Engineer, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Any order given by the Engineer, not otherwise written request of the Contractor, be confirmed in writing. The Contractor shall give efficient supervision to the work, using his best skill and attention.

b) If the Contractor, in the course of the work, finds any discrepancy between the drawings and the physical conditions of the locality, or any errors or omissions in drawings or in the layout as given by points and instructions, it shall be his duty to immediately inform the Engineer, in writing, and the Engineer shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

GC-14 CONTRACTOR'S UNDERSTANDING

a) It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality, and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained.

b) Before commencing work on any branch or part of the work, the Contractor shall examine all areas, surfaces and spaces to which any work for this project will be attached or in which said work will be placed. The Contractor shall report necessary corrections immediately to the Engineer, and shall not proceed until correction (if any required) have been made. Commencing work on any surface or in any area or space implies the Contractor's acceptance of said surface, area and space as ready to receive his work, and also his acceptance of all job conditions. The Contractor shall verify all levels, dimensions and obtain all necessary measurements at the site of the work.

END OF SECTION

PART 1 - GENERAL

1.2 SCOPE OF WORK - The scope of work shall consist of providing all labor, materials, equipment, and services required in the excavation, trenching, and backfilling for utilities systems.

1.3 CONNECTION TO EXISTING UTILITIES - Contractor shall coordinate with representatives of all utilities to be connected into. Contractor shall coordinate with the Owner for all interruption of utilities and shall submit to the Owner a schedule of all interruptions.

1.4 SUBMITTALS - Contractor shall submit to the Engineer in a timely manner all test results specified herein. Failure to submit in a timely manner may be cause for suspension of work.

1.5 TESTING - All testing shall be done by an approved Testing Laboratory. This testing laboratory shall be approved by the Engineer prior to construction.

PART 2 - MATERIALS

2.1 SOIL MATERIALS - In general, shall be free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, frozen, deleterious, or objectionable matter.

2.1.1 BACKFILL - Shall conform to the general requirements for soil materials above and shall be classified as GM, SM, SC, by ASTM D 2487 with a maximum particle size of 3 inches.

2.1.2 SUBGRADE MATERIALS FOR ROADS AND PAVED AREAS - Shall conform to the general requirements for soil materials above and shall be classified as GW, GP, GM, SW, SP, SM by ASTM D 2487 and meet the following: liquid limit shall not exceed 35 percent (35%) when tested in accordance with ASTM D 423, plasticity index shall not exceed 12 percent (12%) when tested in accordance with ASTM D 424, and not more than 25 percent (25%) by weight shall be finer than the number 200 sieve.

2.1.3 SAND - Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as SW or SP by ASTM D 2487 of which no more than 10 percent (10%) by weight shall be finer than the number 200 sieve.

2.1.3.1 CONCRETE SAND - Shall conform to the general requirements for sand above and gradation shall conform to fine aggregate requirements in accordance with ASTM C 33.

2.1.4 GRAVEL - Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as GW, GP by ASTM D 2487 of which no more than 10 percent (10%) by weight shall be finer than the number 200 sieve.

2.1.4.1 CRUSHED STONE - Shall conform to the general requirements for gravel above and a minimum of 10 percent (10%) of the particles shall have at least one fractured face and size in accordance with ASTM C 33.

2.1.5 BEDDING - Shall be concrete sand, gravel or crushed stone or as indicated on the drawings.

2.1.6 BORROW - Shall be materials conforming to the requirements for sand, gravel, bedding or backfill. Other borrow materials from approved sources off Owner's property.

PART 3 - EXECUTION

3.1 GENERAL - Limits of excavation shall be as required for construction and/or as indicated on the drawings.

3.2 SURFACE PREPARATION

3.2.1 CUTTING PAVEMENT, CURBS, AND GUTTERS - Make cuts with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one (1) foot beyond each edge of pits.

3.3 GENERAL EXCAVATION - Shall be to the elevations and dimensions indicated or otherwise specified. Keep excavations free from water while construction is in progress. Notify the Engineer immediately in writing if it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated. Make trench sides as nearly vertical as practical except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe, conduit or duct. Excavate ledge rock, boulders, or hard materials to an over depth at least 4 inches below the bottom of the pipe, conduit, or duct and appurtenances unless otherwise indicated or specified. Blasting will not be permitted. Stabilize soft, weak, or wet excavations as indicated. Use bedding material to refill over depths to the proper grade and place 6-inch maximum layers. At the option of the Contractor, the excavations may be cut to an over depth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe, conduit, duct or structure on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded and dimension as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. All excavation shall be unclassified material, unless otherwise indicated.

3.3.1 ROCK EXCAVATION - When so indicated and provided for classified excavation the following definitions shall apply.

3.3.1.1 GENERAL - For purposes of identifying and measuring rock which may be encountered during excavation, the following definitions shall be used. The definitions are based on minimum equipment requirements which must be equalled or exceeded by the Contractor. If Contractor chooses to use equipment of lessor size, capacity or power than specified for excavating purposes, Contractor will assume all responsibility for the cost and method of removal of material resembling rock which cannot be removed with his equipment. Therefore, the Contract Unit Prices submitted by the Contractor for rock excavation will only be applicable if the Contractor's equipment equals or exceeds the equipment requirements specified below.

3.3.1.2 GENERAL EXCAVATION - Rock is defined as any sound and solid mass, layer, or ledge of mineral matter in place and of such hardness and texture that it cannot be effectively loosened or broken down in a single pass with the following equipment:

3.3.1.2.1 A late model crawler-type tractor rated with at least 200 net flywheel horsepower, equipped with a hydraulic ripper with one digging point of standard design and adequate size, and with tractor operating in low gear, or:

3.3.1.2.2 A three cubic yard (3 cu. yd.) capacity front-end loader, or:

3.3.1.2.3 A 3/4 cubic yard capacity hydraulic backhoe or shovel.

3.3.1.3 PIT AND/OR TRENCH EXCAVATION - Rock is defined as any natural, undisturbed subsurface material encountered during pit and/or trench excavation operations which cannot be excavated and removed by a 3/4 cubic yard capacity hydraulic backhoe.

3.3.2 INTERFERENCES - Where excavation and trenching operations intersect trees or tree root systems, the trees and the main portion of its root system shall be removed unless otherwise directed by the Engineer. The excavation left by the removal of the trees shall be backfilled, compacted and graded as specified.

3.3.3 REMOVAL OF UTILITY LINES - When utility lines that are to be removed are encountered within the area of operations, the Owner shall be notified in ample time for the necessary measures to be taken to prevent interruption of the service.

3.4 GENERAL BACKFILLING - Surround pipes, conduits, or ducts with backfill as indicated. Ensure that backfill is placed completely under pipe haunches. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 12-inch maximum loose lifts unless otherwise specified. Compact loose lift as specified in Paragraph "Compaction" before placing the next lift. Do not backfill in freezing weather, where the material in the trench is already frozen or is muddy, except as authorized. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities.

3.5 COMPACTION - The Contractor shall have compaction tests made, at his own expense, on trench backfill at the rate of one test per six (6")inch lift per 500 lineal feet of trench for the initial two (2) feet of backfill over the pipe. The remainder shall be tested at the rate of one test per two (2) foot depth of backfill per 500 lineal feet of trench.

3.5.1 TESTING LABORATORY - Testing Laboratory shall be approved by the Engineer prior to construction. The test results shall be submitted directly to the Engineer in a timely manner. Failure to do so may result in the suspension of work.

3.5.2 DEGREE OF COMPACTION - Backfill shall be tamped in six (6) inch lifts and thoroughly compacted by a mechanical tamper to ninety percent (90%) of the Modified Proctor Test or that of the surrounding ground surface, except under pavements. Compaction shall be ninety-five percent (95%) of the Modified Proctor Test under pavements.

3.6 PROTECTION OF EXCAVATION

3.6.1 SHORING AND SHEETING - Provide shoring, bracing, cribbing, underpinning and sheeting if required.

3.6.1.1 Prevent undermining of pavements and slabs.
3.6.1.2 Banks may be sloped where space permits and as directed.

3.6.1.3 Where shoring and sheeting materials must be left in place in the completed work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 3 feet below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

3.6.2 DE-WATERING - Include in de-watering the collection and disposal of all forms of surface and subsurface water that are encountered in the course of construction. Water shall be removed by pumping or other methods to prevent the softening of surfaces exposed by excavation. Relieve the hydrostatic head in previous zones below the subgrade elevation in layered soils in order to prevent uplift. Operate the de-watering system continuously, 24 hours per day, 7 days per week until such time as construction work below existing water level is complete, unless directed otherwise.

3.7 FINISH OPERATIONS

3.7.1 GRADING - Shall be to finished grades indicated within one-tenth (1/10) of a foot. Existing grades which are to remain but are disturbed by the Contractor's operations shall be graded as directed.

3.7.2 BORROW AREAS - Shall be graded to drain properly. Maintain and restore borrow pits.

3.7.3 DISPOSITION OF SURPLUS MATERIALS - Surplus or other soil material not required or suitable for filling, backfilling or grading shall be removed from Owner's property.

3.7.4 PROTECTION OF SURFACES - Protect newly graded areas from traffic, erosion, and settlement that may occur. Repair or re-establish damaged grades, elevations or slopes.

END OF SECTION

DIVISION 2 - SITEWORK & DEMOLITION
SECTION 2B - SANITARY SEWERS

PART 1 - GENERAL

1.1 General

A. The work for this section consists of furnishing all new materials, equipment, labor and tools required for the construction of sanitary sewers and appurtenances and work as required by the plans and specifications.

B. Sewers shall be constructed as shown on the plans. The Contractor shall be careful to preserve stakes and survey marks from damage or dislocation. The Contractor shall furnish all batter boards and labor for setting them and shall fully cooperate with any of the survey work. The contractor shall be responsible to insure the line is constructed to the proper grade and location.

C. All construction for the sewer lines shall conform to plans as approved by the Missouri Clean Water Commission(for DNR). For Counties use County Health Department.

1.2 Trench Excavation and Backfill - Trench excavation and backfill shall conform to Section 2A, Earthwork for Utilities.

PART 2 - PRODUCTS

2.1 Sanitary Sewer Pipe – Pipe shall be green in color. Blue pipe shall not be acceptable.

A. Gravity sewers shall be constructed of the following materials as indicated on the plans.

Polyvinyl Chloride (PVC) Pipe

(1) PVC pipe sewers shall be of the size and to the alignment and grade shown on the plans. This pipe shall meet the requirements of ASTM D-3034 SDR35.

(2) Joints shall conform to ASTM D3212 standard specifications for joints and drain and sewer plastic pipes using flexible elastomeric seals.

(3) The PVC pipe shall be available in standard laying lengths of 10' and 20'.

B. Pressure sewers shall be manufactured from polyvinyl chloride ASTM Type 1, Grade 1, (normal impact), designated of PVC 1120 and shall conform to ASTM D-2741, Class 200 SDR 21.

2.2 Concrete for Encasement -

A. Concrete for encasement shall consist of the following proportions:

For concrete if mixed in a mixer with the aggregate weighted, each cubic yard of concrete shall contain not less than four (4) sacks of cement, with the necessary amounts of fine and coarse aggregate and water limited to a maximum of eight and one-half (8 ½) gallons of total moisture per sack of cement so as to develop a minimum twenty-eight (28) day strength of two thousand (2,000) psi. If mixed in small batches where volume measurement is used, concrete shall be proportioned with one (1) sack of cement, not more than three (3) cubic feet of fine aggregate and not more than five (5) cubic feet of coarse aggregate with a maximum of eight and one-half (8 ½) gallons of water

per sack. Allowance for moisture content in the aggregate and for bulking of the fine aggregate must be taken into account.

B. Concrete encasement shall be installed where shown the plans; also where, in the opinion of the Owner's representative such pipe reinforcement is necessary because of unforeseen conditions.

C. The concrete shall extend a minimum of six inches (6") beyond the outside of the pipe in all directions. Each length of pipe shall be held in place to prevent dislocation or flotation.

D. The trench shall be kept reasonably free of water until the concrete has set enough to prevent damage by water.

2.4 Air Release Assemblies –

Air Release Assemblies are to be either manual or automatic assemblies, with Air Release Vacuum Valves that are corrosion resistant, and operable with a minimum line pressure of 2 psig, stainless steel straining #40 mesh with a surface area of 33 sq in, ball valves and fittings shall be SCH 40 PVC, Unions SCH 80 PVC. Assembly shall be enclosed in 24" dia riser, with fiberglass lid with vent, insulation and carbon filter.

2.5 Cleanouts -

Clean out risers shall be of the same material and diameter as the sewer line. The cleanout shall connect to the sewer line with a Wye or Sanitary Tee. If a Wye is used, the riser may be extended to the ground surface at a 45° angle, or a 45° elbow may be used and the riser extended vertically to the surface.

The riser shall be closed with either a screw in plug or with a removable cap. The riser shall be terminated at the ground surface so that it will not be damaged by mowing equipment but is accessible with minimal digging

PART 3 - EXECUTION

3.1 Installation and Construction -

A. All materials shall be as herein specified or as indicated on the plans. All materials shall be delivered and distributed along the site of the work by the contractor. Pipe, fittings, etc., shall be loaded and unloaded so as to avoid shock or damage.

B. The Contractor may lay pipe in the manner best adapted to securing speed and good results. It shall, however, be in accordance with the manufacturer's instructions and recommendations, and in a manner that will not damage the pipe. Where it is necessary to cut the pipe, care must be taken not to crack the pipe, damage any lining and to cut straight and true around it. Cuts on PVC pipe shall be beveled to 1/3 pipe wall thickness.

C. The pipe and fittings shall be inspected for defects.

D. Joints shall be made as previously specified.

E. Air Release Assemblies shall be installed as indicated on plans.

F. Damaged or unsound pipe or fittings will be rejected. All pipe shall be laid with bells uphill. Joints shall be made as specified above. Before jointing the pipe, all lumps, blister, excess coating material and any grease or oil shall be removed from gaskets and the bell and spigot ends of pipes.

Every precaution shall be used to protect the pipe against the entrance of foreign material before the pipe is placed. At the close of the day's work or whenever the workmen are absent from the job site, the end of the last laid section of pipe shall be closed to prevent the entry of foreign material.

G. Horizontal Separation of Water Mains for Gravity Sewers - Whenever possible, the sewers and manholes should be located at least ten feet (10") horizontally from any existing or proposed water line. Should local conditions prevent a lateral separation of ten feet (10') a sewer may be laid closer than ten feet (10') from a water main if it is in the same trench with the waterline located at one (1) side on a bench of undisturbed earth. In either case the elevation of the crown of the sewer must be at least eighteen inches (18") below the invert of the water line. Whenever sewer must cross under water lines and the sewer cannot be buried to meet these requirements, the water line shall be relocated to provide this separation or the sewer line constructed of slip-on or mechanical joint cast iron pipe, asbestos cement pressure pipe or PVC pressure pipe for a distance of ten feet (10') on each side of the water line and be pressure tested to assure watertightness.

H. Horizontal Separation of Water Mains for Pressure Sewers – Water line and sewage force main separation. There shall be at least a ten foot (10') horizontal separation between water lines and sewage force mains. There shall be an eighteen-inch (18") vertical separation at crossings only extenuating circumstances, with approval from MDNR will deviations be allowed to these minimum separation distances.

3.2 Concrete Placement -

A. Concrete encasement shall be installed where shown the plans; also where, in the opinion of the Owner's representative such pipe reinforcement is necessary because of unforeseen conditions.

B. The concrete shall be as previously specified and shall extend a minimum of six inches (6") beyond the outside of the pipe in all directions. Each length of pipe shall be held in place to prevent dislocation or flotation.

C. The trench shall be kept reasonably free of water until the concrete has set enough to prevent damage by water.

3.4 Testing -

A. All new gravity sewer lines shall be lamped before being placed in service. If the lines do not lamp to reasonably near a full circle, or if low spots are disclosed, the Contractor shall locate the cause and make such repairs or replacements as may be necessary to correct the defects.

B. All new gravity sewer lines shall be tested for exfiltration before being placed in service. The time of determining the leakage on each line will be determined by the Owner's representative.

The Contractor shall furnish all water, labor, assistance, etc., necessary for the performance of the tests. If the exfiltration exceeds two hundred (200) gallons per inch of pipe diameter per mile of pipe (or if measured infiltration exceeds the above), the Contractor shall locate the principal leakage and make repairs as required to reduce the total exfiltration or infiltration rate below the rate specified. Duration of the test shall be 24 hours.

The pressure test shall be made after the completion of backfilling operations and after the concrete thrust blocks have set for at least thirty six (36) hours. The duration of the pressure tests shall be a minimum of one (1) hour unless otherwise directed by the engineer. The test pressure shall be 2 ½ times the maximum system operating pressure or 50 psi minimum. All Tests are to be conducted under the supervision of the engineer.

END OF SECTION

PART 1 - GENERAL

1.2 SCOPE OF WORK

1.2.1 The work under this Section consists of furnishing all materials, accessories, equipment, tools transportation, service, labor and performing all operations necessary to completely execute the Force Main work for this project, all as indicated on the Drawings, approved Shop Drawings and as specified herein.

1.2.2 Build all Force Main work of sizes, sections and materials at locations, and to grades shown on Drawings; provide all concrete work, junctions, connections, road and creek crossings and appurtenances, all as indicated on Drawings, as herein specified, attached hereto, and made a part hereof.

1.2.3 This shall include all incidental work such as removal of trees, roots, and all other obstacles, and restoration of existing surfaces.

1.3 SHOP DRAWINGS - Contractor shall submit to the Engineer for approval shop drawings. Shop drawings shall show Force Main pipe details, data and certificates as required.

1.4 LAYOUT - All necessary lines, levels and grades will be given to the Contractor, who shall provide at his own expense and without extra cost to Owner, all forms, materials and manual assistance (including rodmen for surveys) as required therefore by Engineer. The Contractor shall preserve in their proper places all stakes set for line, grades and measurements of the work until their removal is authorized by Engineer. The Contractor shall replace at his own expense and without extra cost to Owner: all stakes destroyed through the Contractor's carelessness, negligence or which he failed to preserve.

1.5 ACCESS - Place excavated materials and materials used in construction so as not to endanger the work and so that there is free access at any time to all parts of trench, and to all water valves in the vicinity.

1.6 INSPECTION - On completion of each block or section of Force Main or at such times as the Engineer may direct, a block or section of Force Main shall be cleaned, tested and inspected. All repairs shown necessary by the inspection shall be made. Broken or cracked pipe shall be replaced; defective joints, if any, replaced; all deposits removed; and the sewer left true to line and grade, entirely clean, free from lumps of protruding jointing materials, etc., and ready for use.

1.7 PRESSURE TESTS

1.7.1 Test ALL piping and connections installed under this contract. Trenches may be backfilled prior to pressure tests, but not before work has been visually inspected by the Engineer. If pressure tests indicate leaks in piping, it shall be the Contractor's responsibility to determine location of leaks, excavate as required, repair leaks, re-test and backfill.

1.7.2 Perform each test as specified hereinafter and continue or repeat until the lines under test are proven tight to the satisfaction of the Engineer. Furnish all materials, pumps. gauges, plugs, etc. required for tests. Notify the Engineer in writing seven (7) days in advance of tests so he may witness same.

1.7.3 Devices or equipment which may be harmed by test pressures shall be removed or protected during tests.

1.7.4 Force Main shall be water tested at 100 PSI for 4 hours.

1.8 GUARANTY

1.8.1 The Contractor shall and hereby does guarantee that all material work for Force Main construction shall be free from defects of materials and labor and shall be and remain in good condition for a period of one (1) year from date of Owner's final acceptance of same.

1.8.2 The Contractor shall and thereby does further agree that he will, at his own expense and without extra cost to Owner, remove, repair and replace all said defective work occasioned during the one (1) year Guaranty period and that he will also make good at his won expense and without extra cost to the Owner, any and all damages to other work caused by such repair and replacement operations.

PART 2 - MATERIAL

2.1 FORCE MAIN - ASTM Type 1 Grade 1 (normal impact), Class 200, SDR 21, Polyvinyl Chloride (PVC 1120), Sewer Pipe. Pipe bell shall be designed for assembly by pre-positioning a continuous, molded rubber-ring gasket in an angular recess in the pipe socket. Size and shape of the gasket shall be such to provide adequate compressive force between the spigot and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerance. Joint shall conform to ASTM D3139. It shall have no deteriorating effect on gasket or pipe material.

2.2 PVC PIPE LUBRICANT - Lubricant shall be suitable for lubricating the joint components. It shall have no deteriorating effect on gasket or pipe material.

2.3 AIR RELEASE VALVES - See Section 2B, Part 2 - Products 2.4.

PART 3 - EXECUTION

3.1 EXCAVATION

3.1.1 All excavation work for force main and appurtenances includes: clearing of the site, loosening, loading, removal, transporting and disposal of all excavated materials (wet or dry) necessary to be removed and replaced (backfilling) for purposes of construction. Such work also includes: all backfilling operations and all replacements to conditions equal to or better than those existing prior to excavating operations. All excavation: Unclassified unless otherwise specified.

3.1.2 In general, trenches shall be only of sufficient width to provide a free working space on each side of the pipe sewer according to the size of the pipe and the character of the ground as shown on the plans; but, in every case, there shall be sufficient space between pipe and the sides of the trench to make it possible to thoroughly ram the bedding around the pipe and to secure proper tight joints. Width of trench at top of sewer pipes shall not exceed the dimensions shown on the Drawings; greater width may be permitted only by Engineer's signed consent and where necessary for proper construction of sewer.

3.1.3 Place excavated materials and materials used in sewer construction so as not to endanger the work and so that there is free access at any time to all parts of the trench and to all water valves in the vicinity.

3.1.4 Where sand backfill is required, the Contractor shall remove all surplus excavated materials from trench and streets as soon as excavated, at his own expense and without extra cost to Owner.

3.1.5 Excavation of trench shall not advance over three hundred feet (300') ahead of completed work, except where, in Engineer's opinion, it is necessary to drain wet ground.

3.1.6 The Contractor shall and hereby does assume entire responsibility and risk of encountering quicksand, hardpan, boulder clay, rubbish, unforseen obstacles, underground conduit and utilities, railroad tracks, pavements, and other obstacles. No claim for extra payment over and above the amount of the Contract price for this work will be considered or paid to the Contractor on account of obstacles and character of ground in which trench and other excavations are made.

3.1.7 Where rock is encountered in trench excavation, excavate the trench to the width and as shown on the drawings for Class B bedding as directed by the Engineer. All excavation shall be unclassified, unless otherwise provided for in these specifications or noted on the drawings.

3.1.8 Where rock is encountered in trench excavation, excavate the trench to the width and as shown on the drawings for Class B bedding as directed by the Engineer. ***All excavation shall be unclassified, unless otherwise provided for in these specifications or noted on the drawings.***

3.2 BLASTING - If blasting is needed when excavating trench, it must first be approved by the Engineer. The Contractor shall and hereby does assume entire responsibility for accidents and damage to public and private property, which are caused by blasting operations and the use or storage of explosives. He shall make good at his own expense any and all such damage(s) without extra cost to Owner. The Contractor shall observe all precautions against said damage(s), and shall immediately comply with Engineer's directions regarding blasting methods, quantities of explosive used and protection. Should the Contractor fail to obey Engineer's instructions and continue to use methods which, in the Engineer's opinion, are likely to cause damage, he will be required to cease blasting.

3.3 SHEETING, SHORING AND BRACING

3.1.1 Provide in place and maintain all sheeting, shoring and bracing required to support sides of excavation and prevent all movement which can in any way injure the sewers, diminish necessary width of excavation and otherwise damage or delay the work or endanger adjacent pavements, buildings, and structures. Use care to prevent voids outside sheeting; in case they occur, fill and solidly ram same immediately and to Engineer's satisfaction.

3.1.2 Unless otherwise specified herein, remove sheeting and bracing. Do said work in such manner as shall not endanger constructed sewer, other structures, utilities, public and private property. Fill all voids (left or caused by said removals) with sand immediately; compact same solidly by ramming with tools specially adapted to that purpose, by watering or otherwise, as directed.

3.1.3 No separate payment will be made for installing, maintaining and removing sheeting, bracing and similar items. The Contractor shall include compensation therefor in his price per linear foot of sewer.

3.4 PROTECTION AGAINST WATER

3.4.1 Do all pumping, bailing, build all subdrains and drains; in wet trenches, form all dams; flumes, and do all other work necessary to keep all trenches free from water during progress of work and while sewers and their foundations (if any) are being constructed. Protect all newly laid mortar and fresh concrete from damage resulting from dewatering by means of waterproofed membrane or other approved methods.

3.4.2 Where excavation, for its depth, is wholly or partly in wet sand or where, in Engineer's opinion, job conditions require, the Contractor shall install a drainage system (gravel subdrain, well points, etc.), which shall effectively drain water from water-bearing strata.

3.5 PIPE LAYING OPERATIONS

3.5.1 Lay all pipe, under all conditions, in a dry trench on an even, firm bed throughout full length of the barrel and so that no uneven strain is placed on any pipe. Maintain dry trench at all times. Conduct all pipe laying operations so as to insure proper subsequent lateral and vertical

alignment of pipe and also eliminate ground water infiltration. Bed pipe full length of barrel by hand shaping bedding material so that a firm, even bearing will result for bottom quadrant of pipe, as shown on Drawings. Make bell holes carefully (for bell end pipe) and no larger than required to properly free bell from bearing on subgrade or bedding and to properly make pipe joints. Provide bell holes also for tongue and groove pipe, adequate to assure that no granular drawing-up of the joint.

3.5.2 Lay socket end of all pipe upgrade. Insert spigot end of the next pipe into socket until face of spigot is in contact, all around, with shoulder of pipe. Join pipes in accordance with manufacturer's recommendations.

3.5.3 After pipe is joined, ram and tamp bedding material into bell hole, so that no voids occur in the bedding.

3.6 BACKFILLING

3.6.1 After laying force main, and bedding same in open cut, as specified in Pipe laying Article, backfill trenches to original ground surface. Unless otherwise directed, do not leave backfilling unfinished for over three hundred feet (300') behind completed pipe work.

3.6.2 In sheeted sections, do not withdraw sheeting until trench is sufficiently filled to prevent injury to banks, road surfaces, sidewalks, adjacent utility structures of other public and private property.

3.6.3 Plastic Marking Tape - Warning tapes shall be installed directly above the force main pipe, at a depth of 18 inches below finished grade unless otherwise shown. Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise with an elongation factor of 350 percent. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1 - TAPE COLOR

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

3.7 CONCRETE ENCASEMENT FOR SEWER PIPE - See Section 2B, 2.2. Where concrete encasement for pipe is indicated on Drawings or otherwise by Engineer's signed order, provide concrete as specified in the Concrete Division, including placing and handling thereof. Encasement: at least the minimum dimensions indicated on the Drawings. Fill entire trench bottom with rammed

and compacted concrete or other approved, selected materials (as shown on Drawings) for entire width of excavation and with no voids or pockets remaining. During construction, support pipe in place on blocks or wedges; ram and tamp concrete solidly under and around it. Backfill with approved, compacted, selected materials to plane 12 inches above top of concrete in conformance with specification requirements for beddings. Said backfill shall be included with and considered a part of concrete encasement.

3.9 PROTECTION OF WATER SUPPLIES - See Section 2B, 3.1G. Where conditions prevent the minimum (18 inches) vertical separation from being maintained, or when it is necessary for the water main to pass under a sewer or drain, the water main shall be laid with Class 200 PVC prestressed concrete cylinder pipe, and the water main shall extend on each side of the crossing to a distance from the sewer of at least 10 feet. In making such a crossing, a full length of water main pipe must be centered over or under the sewer to be crossed, so that the joints will be equidistant from the sewer and as remote therefrom as possible. The sewer line must also be constructed of Class 200 PVC until the normal distance from the sewer line to the water main shall be maintained, with adequate support. The sewer shall be constructed of Class 200 PVC for a distance of 10 feet on either side of the crossing, or other suitable protection as approved by the Engineer.

3.11 CLEARING AND MAINTENANCE OF SEWER

3.11.1 Exercise care during construction to prevent sand and rubbish (all kinds) from entering or remaining in lines. Remove rubbish and sand promptly and periodically, as the sewer work progresses. As construction nears completion, clean entire system thoroughly and make all necessary adjustments, repairs, and replacements throughout entire length. Provide all required tools, equipment, water (for flushing lines) and labor for said cleaning and repair work. Arrange and conduct cleaning and repair work, as far as practicable, so it and sewer construction work will be completed at the same time. Upon completion of cleaning work, the Owner will make final inspection of same.

3.11.2 Upon completion of construction, dismantle and remove all building and other structure provided and erected in order to facilitate construction. Remove all rubbish from the ground occupied by said structure and leave entire line of work clean, in good condition and so approved. Include cost of all cleaning, repairs, maintenance, and leaving lines ready for operyation in unit price bid by the Contractor for all pipe in place complete.

3.12 CLEANUP - At completion of the job, Contractor shall remove all trash, rubble, rocks and extraneous materials left by his work. Any damage done to the surrounding area by the Contractor shall be restored to equal or better condition.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK - The manufacturer shall provide the structural design and certification to the engineer for review. The design shall be in accordance with accepted engineering practice. Precast concrete or fiberglass tanks shall have been designed by a registered engineer and approved by state or local regulatory agencies, or authorities.

1.1.1 Loading Criteria:

a. There shall be 140 pcf for minimum weight of saturated backfill, or 127 pcf for unsaturated backfill (500 psf minimum).

b. Minimum lateral loading shall be 62.4 pcf. Lateral loading shall be determined from ground surface.

c. The tank shall also support a concentrated wheel load of 2500 lbs.

There are four (4) Typical loading conditions that should be analyzed:

1. 4 ft. Bury + Full Exterior Hydrostatic Load
2. 4 ft. Bury + Full Exterior Hydrostatic Load + 2500 lb. Wheel Load.
3. 1 ft. Bury + 2500 lb. Wheel Load.
4. Tank Full, Interior Hydrostatic Load and Unsupported by Soil.

Load Case 4 represents the tank full of liquid at 62.4 lbs/cu.ft. This condition addresses seam and haunch stress-strain relationships that occur during watertightness testing, as well as poor soil bedding conditions that provide inadequate support.

1.1.2 Tanks requiring deep burial (>48") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12 inches shall be used, unless specified otherwise by manufacturer.)

1.1.3 *All tanks shall be structurally sound and watertight and* shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not have a limited liability in regards to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.

1.1.4 Tanks shall be manufactured and furnished with a minimum access opening of 20 inches in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.

1.1.5 Inlet plumbing shall include an inlet tee which penetrates 18 inches into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth.) The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

1.1.6 Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.

1.1.7 Tanks shall be installed in strict accordance with the manufacturer's recommended installation instructions.

1.2 FIBERGLASS TANKS

1.2.1 Method of Calculations:

a. Fiberglass tanks shall be analyzed using finite element analysis for buried structures.
b. Calculations shall address the following:
   1. strength with a minimum safety factor of 2.5
   2. buckling with a minimum safety factor of 2.5
   3. deflection of 5% of the tank diameter, based on service load (including long-term deflection lag)
   4. buoyancy
c. Performance testing

1.2.2 Material Properties and Laminates - The laminates considered in this analysis shall be of general-purpose ortho-polyester resin with E-type fiberglass reinforcement or higher grade. The thicknesses for different regions of the tanks shall be described and shown in shop drawings for each individual tank.

Typical primary strength properties are listed below:

Tensile Modulus (psi)	1,000,000
Ultimate Tensile strength (psi)	10,000
Ultimate Compressive strength (psi)	21,000
Ultimate Flexural strength (psi)	18,000
Ultimate Shear In-Plane (psi)	7,800

1.2.3 In lieu of calculations for fiberglass tanks, the supplier may elect in-situ performance testing.

1.2.4 In-situ testing of each tank model shall include use of strain gauge and deflection gauge. The tank will be subjected to external forces equal to twice the actual load.

1.2.5 Maximum initial deflection based on test loading shall not exceed 3% of the tank diameter.

1.2.6 Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on any of the tank models.

1.2.7 The tank shall be constructed with a glass fiber and resin content specified by the manufacturer and with no exposed glass fibers. Any metal part shall be 300 series stainless steel.

1.2.8 Inspections may be made by the engineer in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16-inch. If the wall thickness is suspected to be less than 3/16-inch or if delamination is suspected within any portion

of the tank, the engineer may drill a 1/4-inch diameter hole through the tank wall for inspection purposes. If the required minimum 3/16-inch thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this bid will become suspect of substandard quality and subject to rejection by the engineer. If the required minimum 3/16-inch thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the engineer.

1.2.9 The engineer shall specify the minimum weight of each tank model that will be allowed. The manufacturer will permanently mark the weight of each tank on the top near the access hole.

1.2.10 The minimum tank weight shall be specified by the manufacturer's engineer (i.e., 350 lbs for 1000 gallon tanks ...400 lbs for 1500 gallon tanks ±).

1.2.11 Holes specified for the tank shall be provided by the manufacturer. Resin shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.

1.2.12 Orenco Systems®, inc. EPDM gaskets, or approved equal, shall be used at the inlet to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.

1.2.13 Inlet plumbing shall include an inlet tee that penetrates 18-inches into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

1.2.14 Water testing shall be performed on each tank and shall be witnessed by the engineer. Every tank shall be assembled by the manufacturer and filled with water to the brim of the access opening for a minimum of two (2) hours. The tank shall show no leakage from section seams, pin-holes or other imperfections. Any leakage is cause for rejection.

1.2.15 When leakage occurs, if the tank is not rejected by the engineer, an additional water test shall be made on the tank after repairs have been completed, upon request by the engineer. The manufacturer shall be responsible for making all corrective measures in production or assembly necessary to ensure a completely watertight tank.

1.2.16 After installation of tank with riser is completed, each tank shall be filled with water to a point two (2) inches into the access riser and the water loss measured after a two-hour period. Every tank test shall be witnessed by the engineer. Any leakage shall be cause for rejection. Backfill of a depth equal to the water height in the riser must be in place over the tank to prevent damage due to hydrostatic uplift.

1.2.17 Each tank shall be marked in the upper most surface above or near the outlet and include a permit number or identification number, weight of tank, type of tank, and date of manufacture.

1.2.18 Installation shall be in accordance with the manufacturer's recommendations, or as shown on the Contract Plans, whichever is more stringent; no variations.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15C - PRIMARY SEPTIC TANK EFFLUENT PUMPING ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE OF WORK - All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems, Inc. High-Head Pumping Assemblies or approved equal, composed of:

1.1.1. Risers - Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

1.1.2. Inlet and Cleanout Risers - Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall extend to two inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 18-inches. See section 3b below for adhesive requirements.

1.1.3. Outlet Risers - Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall be at least 12 inches high, and shall be factory-equipped with the following:

a. Electrical and Discharge Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or equal, or a single component adhesive Model ADH100 or approved equal shall be used.

1.1.4 Lids - One lid shall be furnished with each access riser. Lids shall be Orenco Systems®, Inc. Model FL24-4B, FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

1.1.5. Optional Components -

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, part number 6024, 3060, 4036, as manufactured by Sather Manufacturing Co., Inc., or approved equal, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

1.1.6. Riser Installation - Riser installation shall be accomplished according to the manufacturer's instructions.

1.1.7. Pump Vaults - Orenco Systems, Inc. Model PVU Series, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet. (Note: Commercial and multiple-user tanks may require a larger or duplex Biotube Pump Vault, the sizes of which must be individually determined and spelled out in the specifications.) The Biotube Pump Vault shall consist of a 12-inch diameter HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube® assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

1.1.8. Discharge Hose and Valve Assembly - Orenco Systems®, Inc. Model HV125BC, HV150BC or HV200BC, 1.25-inch, 1.50-inch or 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with minimum working pressure rating of 64 psi, and Schedule 40 PVC pipe. When pumping downhill, include anti-siphon assembly.

1.1.9 Float Switch Assembly - Orenco Systems, Inc. Model MF4A with four switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms, on and off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

1.1.10. High Head Effluent Pumps - Must be approved for use in pump vault Orenco Systems, Inc. Model P1005 with 1/4" flow controller, 1/2 hp, 115/230 VAC, single phase, 60 Hz, two-wire motor, delivering 5.7 gpm @ 167 ft TDH with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty.

1.1.11. Electrical Splice Box - Orenco Systems, Inc. Model SB6, UL approved for wet locations, equipped with six electrical cord grips and a 1-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit. Substitute Model SB4, equipped with four electrical cord grips and a 3/4-inch outlet fitting and Model SBX-D for Class 1, Division 1 applications.

1.1.12 Controls and Alarms (see Alternate): - Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model MVP-DAX1RO or MVP-DAX2RO control panel meeting the following:

Standard Components:

a. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.

c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

d. Audio Alarm: 80 dB at 24", warble-tone sound.

e. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

f. Panel Enclosure: Measures13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

g. MVP-DAX1RO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.

h. MVP-DAX2RO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.
i. Event Counter: 115 VAC, 6-digit, non-resettable.
j. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

Optional Components: -
k. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.
l. Heater: Anti-condensation heater. Self-adjusting; radiates additional wattage as temperature drops.
m. Intrinsically Safe Controls Relays: 115 VAC. Listed per UL 913, for Class I, Div. I, Groups A, B, C, D hazardous locations. Larger enclosure required.
n. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

Alternate: VeriComm® Remote Telemetry Control System - Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. VCOM-DAX1RO or VCOM-DAX2RO control panel or approved equal, meeting the following:

VeriComm® Remote Telemetry Control System - The system will be monitored via remote telemetry with real time efficiency.

In addition, the control system shall be capable of the following functions:
a. Data Collection and Utilization. Logs data for system conditions and events such as pump run time, pump cycles, and alarm conditions.
b. Downloadable Logs. Down load logs into a *.dif or ASCII format for simple conversion to common spreadsheet or word processor programs.
c. Multi-level Password security. Only qualified personnel can remotely access site.
d. Program Logic Rules. Simple "If ...then" declarations. Rules can be written based on several operands, including the following:
    1. Input / output status
    2. Point status
    3. Date: mm/dd/yy format
    4. Time of day: 24 hour clock
    5. Timers
    6. Historical data (allows for control optimization or detection of trends)
e. Schedule functions to control digital "Points" based on date or day of week/time.
f. Automatic daylight savings time adjustment.
g. Automatic call-out to pagers during alarm conditions when panel detects trends that could lead to system failure.

In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

Standard Components:
a. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 amps, 1 hp.
c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
d. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
e. Audio Alarm: 80 dB at 24", warble-tone sound.
f. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC
g. Panel Enclosure: Measures13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
h. VCOM-DAX1RO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.
i. MVP-DAX2RO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.
j. VeriComm® Remote Telemetry Unit: ATRTU-400; 24 VDC (center tap transformer), 8 digital inputs, 6 analog inputs, 8 digital outputs, on-board modem (9600 baud), and battery backup.

Optional Components:
h. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.
i. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.
j. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 698A, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.
k. Current Sensor: 115 VAC with adjustable high & low alarm set points.
l. Event Counter: 115 VAC, 6-digit, non-resettable.
m. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

1.2. Location: - The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

1.3. Installation: - All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15D - RECIRCULATION / DILUTION TANK PUMPING ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE OF WORK - All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or engineer-approved equal, composed of:

1.1.1. Risers: - Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 24 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

1.1.2. Inlet and RSV Riser: - Risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall extend to three inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 30 inches. See section 4b below for adhesive requirements.

a. Inlet & Outlet Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

1.1.3. Recirculating Splitter Valve (see Alternate): - Orenco Systems®, Inc. Model RSV2U, RSV3U or RSV4U, 2, 3 or 4-inch diameter ball valve assembly to provide guaranteed return of treated effluent returning from filter. The ball valve is designed to redirect 100% of flow to recirculation/dilution tank during periods of low flow or 20% of return flow to final discharge and 80% to the recirculation/dilution tank during periods of high flow. Must be manufactured of corrosion resistant PVC and rubber components and allow for easy removal using unions. The item is patented and the engineer knows of no equivalent.

Alternate: Recirculating Ball Valve:- Orenco Systems, Inc. Model MM2, MM3 or MM4, 2, 3 or 4-inch diameter ball valve assembly to provide guaranteed return of treated effluent returning from filter. The ball valve is designed to redirect 100% of flow to recirculation/dilution tank during periods of low flow or 100% to final discharge during periods of high flow. Must be manufactured of corrosion resistant PVC and rubber components and allow for easy removal using unions. The item is patented and the engineer knows of no equivalent.

1.1.4. Outlet Riser: Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2-inch. Risers shall be at least 12 inches high, and shall be factory-equipped with the following:

a. Electrical and Discharge Grommets: EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser, Model ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or equal, or a single component adhesive Model ADH100 or approved equal shall be used.

1.1.5. Lids: One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL24-4B, FL30G or engineer-approved equal, as appropriate, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Optional Components:

a. Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, part number 6024, 3060, 4036, as manufactured by Sather Manufacturing Co., Inc., or approved equal, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

b. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

1.1.6. Riser Installation:- Riser installation shall be accomplished according to the manufacturer's instructions.

1.1.7. Pump Vault: - Orenco Systems, Inc. Model PVU Series, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet. (Note: Commercial and multiple-user tanks may require a larger or duplex Biotube® Pump Vault, the sizes of which must be individually determined and spelled out in the specifications.) The Biotube Pump Vault shall consist of a 12-inch diameter HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8-inch mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

1.1.8. Discharge Hose and Valve Assembly: - Orenco Systems®, Inc. Model HV125BC, HV150BC or HV200BC, 1.25-inch, 1.50-inch or 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with minimum working pressure rating of 64 psi, and Schedule 40 PVC pipe. When pumping downhill, include anti-siphon assembly.

1.1.9. Float Switch Assembly: - Orenco Systems, Inc. Model MF3A with three switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms, and override on/off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

1.1.10 Head Effluent Pumps: - Must be approved for use in pump vault. For most applications, an Orenco Systems, Inc. Model P500512, 1/2 hp, 230 Volt, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be capable of providing a flow rate of 42.6 gpm against a head of 40.7 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty.

1.1.11 Electrical Splice Box: - Orenco Systems, Inc. Model SB5, UL approved for wet locations, equipped with five electrical cord grips and a 1-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit. Substitute Model SB3, equipped with three electrical cord grips and a 3/4-inch outlet fitting and Model SBX-S for Class 1, Division 1 applications.

1.1.12. Controls and Alarms (see Alternate): - Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. Model MVP-DAX1PTRO or MVP-DAX2PTRO control panel meeting the following:

Standard Components:

a. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

b. Toggle Switch: Single-pole, double-throw MOA switch. 20 amps, 1 hp.
c. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
d. Audio Alarm: 80 dB at 24", warble-tone sound.
e. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC
f. Panel Enclosure: Measures13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
g. MVP-DAX1PTRO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.
h. MVP-DAX2PTRO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.
I. Event Counter: 115 VAC, 6-digit, non-resettable.
j. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

Optional Components:
k. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.
l. Heater: Anti-condensation heater. Self-adjusting; radiates additional wattage as temperature drops.
m. Intrinsically Safe Controls Relays: 115 VAC. Listed per UL 913, for Class I, Div. I, Groups A, B, C, D hazardous locations. Larger enclosure required.
n. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

Alternate: VeriComm® Remote Telemetry Control System
Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. Panel shall be Orenco Systems®, Inc. VCOM-DAX1PTRO or VCOM-DAX2PTRO control panel or approved equal, meeting the following:

VeriComm® Remote Telemetry Control System
The system will be monitored via remote telemetry with real time efficiency.

In addition, the control system shall be capable of the following functions:
n. Data Collection and Utilization. Logs data for system conditions and events such as pump run time, pump cycles, and alarm conditions.
o. Downloadable Logs. Down load logs into a *.dif or ASCII format for simple conversion to common spreadsheet or word processor programs.
p. Multi-level Password security. Only qualified personnel can remotely access site.

q. Program Logic Rules. Simple "If ...then" declarations. Rules can be written based on several operands, including the following:

7. Input / output status
8. Point status
9. Date: mm/dd/yy format
10. Time of day: 24 hour clock
11. Timers
12. Historical data (allows for control optimization or detection of trends)

r. Schedule functions to control digital "Points" based on date or day of week/time.

s. Automatic daylight savings time adjustment.

t. Automatic call-out to pagers during alarm conditions when panel detects trends that could lead to system failure.

In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

Standard Components:

k. Motor-Start Contactor: 115 VAC: 14 FLA, 3/4 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 230 VAC: 14 FLA, 2 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

l. Toggle Switch: Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 amps, 1 hp.

m. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

n. Pump Circuit Breaker: 20 amps, OFF/ON switch. Single-pole 115 VAC, double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

o. Audio Alarm: 80 dB at 24", warble-tone sound.

p. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

q. Panel Enclosure: Measures 13.51" high x 11.29" wide x 5.58" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.

r. VCOM-DAX1PTRO Panel Ratings: 115 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.

s. MVP-DAX2PTRO Panel Ratings: 230 VAC, 2 hp, 14 amps, single phase, 60 Hz.

t. VeriComm® Remote Telemetry Unit: ATRTU-400; 24 VDC (center tap transformer), 8 digital inputs, 6 analog inputs, 8 digital outputs, on-board modem (9600 baud), and battery backup.

Optional Components:

u. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.

v. Heater: Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.

w. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 698A, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.

x. Current Sensor: 115 VAC with adjustable high & low alarm set points.

y. Event Counter: 115 VAC, 6-digit, non-resettable.

z. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.

1.2 Location: - The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select a garage or outbuilding where the sound of the motor contactor engaging will not be noticed. If a garage or outbuilding wall isn't available, installation should include use of sound-deadening insulation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

1.3 Installation: - All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

END OF SECTION

PART I - GENERAL

1.1 SCOPE OF WORK - All components shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for onsite treatment systems. References must be available on request from the engineer.

1.2 Distributing Valve Assembly: - Provided as a complete assembly including inlet ball valve, distributing valve with 2 to 6 outlet ports, Schedule 80 unions for removal and cleaning, and clear PVC ports for inspection. Valve manufactured of corrosion resistant ABS polymer, stainless steel, and die cast metal. Assembly shall be Orenco Systems®, Inc. Model V6000 Series or approved equal. Each distributing valve shall include the following:

a. Distributing valve assembly shall be enclosed in ribbed PVC access riser as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall extend to two inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 30.

b. One lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL30GI2 or approved equal, fiberglass with green non-skid finish, and provided with stainless steel bolts, and wrench. The riser and lid combination shall be sealed for watertightness and able to support a 2500 lb. wheel load. (Note: This is not to imply that PVC risers are intended for traffic areas.)

c. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

1.3. AdvanTex Treatment System: - Orenco Systems, Inc. AX20 AdvanTex Treatment System installed in conformance with the engineer's plans. The AX20 is a packed bed filter, consists of a proprietary textile media. The media has been specifically engineered for wastewater applications. The item is patent pending and the engineer knows of no equivalent.

1.4. Transport Piping / Fittings:

a. All transport piping and fittings from the recirculation / dilution tank shall meet a minimum pressure rating of Schedule 40.

b. The AdvanTex pod return lines shall be 4-inch diameter, Class 125 or higher pressure. All fittings shall be Schedule 40

1.5. Installation - All AdvanTex components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15F - RECIRCULATING COARSE SAND FILTER

PART 1 - GENERAL

1.1 Scope of Work - The work covered by this article of the specifications shall consist of furnishing all labor, materials, and equipment necessary and performing all operations in connection with the construction of a Recirculating Coarse Sand Filter in accordance with the plans and/ or as herein specified.

The Contractor shall assume complete responsibility for all materials furnished and he shall replace, at his own expense, all such materials that are found to be defective or that have been damaged in handling.

1.2 General - The Contractor shall furnish and install one complete recirculating coarse sand filter with all the necessary and needed equipment. He shall construct the necessary filter bed, recirculation tank, furnish and install all necessary equipment to provide a recirculating coarse sand filter complete and ready for operation accordance with these plans and specifications. The system will consist of installation of one (1) 30,000 gallon fiberglass recirculation tank, one (1) 50' x 120' sand filter bed and all piping and equipment needed to complete the treatment system as shown on the plans or as herein specified. The system is to serve an average daily flow of approximately 30,000 gallons/ day of domestic strength wastewater. Primary treatment shall be accomplished with septic tank effluent pumping tanks (STEP). Tanks shall be installed as shown on the plans. The system will be capable of treating approximately 30,000 gallons of domestic wastewater/day to effluent limits that should meet or exceed anticipated NPDES permit limits of 15 ppm TSS and 15 ppm BOD_5.

All incidental work, as shown on the plans, including the excavation, grading, installation of recirculation tank equipment, installation of piping, installation of electrical, installation of septic tanks and needed equipment and all items pertaining there to shall be the responsibility of the contractor, unless specifically indicated otherwise by the owner and/ or engineer.

1.3 Equipment Supplier – Shall have system responsibility and have had a minimum of five (5) successful installations in the past five (5) years (minimum 10,000 gallon installation). Names and Addresses of contact person shall be submitted to Engineer with shop drawings submitted in accordance with General Conditions.

PART 2 - PRODUCTS

2.1 Media - Shall consist of washed creek rock or sand. Crushed stone is not acceptable.

Sand Requirements:

Type	Size
Sand	1.0-3.0mm effective size

uniform coefficient ≤3.0
fines ≤ 1%, fines smaller than .13mm

Washed Rock Requirements:

Nominal Size	Type
.50	Washed Creek Rock, 90% passing ¾" sieve, not more than 10% passing 3/8" sieve

2.2 Distribution Pipe – Shall consist of 2" SCH 40 PVC for the header piping and 1" SCH 40 PVC for the distribution piping. With the distribution lines having a 1/8" hole drilled every two feet, with every 5th hole drilled at the 6 o'clock position, all other drilled at the 12 o'clock position.

2.3 Liner – Shall be made of 30 mil PVC and sized so that the bottom and sides of filter are completely covered. Pipe boots are to be constructed of PVC vinyl and sealed with vinyl cement. There shall be a 2" boot for each distribution header and one 4" boot for each drain pipe.

2.4 Recirculation Tank – Shall have a total volume of 30,000 gallons and shall be made of 100% resin and glass fiber reinforcement with no sand fillers and no exposed glass fibers with 30-inch openings and risers. The tank shall be equipped with a 6" inlet pipe with sanitary tee made of SCH 40 PVC which penetrates 18 inches into the liquid from the inlet flow line. The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack. The tank shall be vented to atmospheric pressure, as the tank is not designed as a pressure vessel. The tank shall be designed to withstand a 5-psi air pressure test with a 5:1 safety factor. The tank shall withstand surface H-20 axle loads when properly installed according to manufacturer's installation instructions. The tank shall be capable of being buried in ground with 7 feet of overburden, and capable of supporting accessory equipment, such as inlet and outlet piping, effluent filter chamber, and baffles. Shall be manufactured of 100% resin and glass-fiber reinforcement, with no sand fillers and no exposed glass fibers. Inlet plumbing shall include an inlet tee,. All tanks shall be installed in strict accordance with the manufacturers recommended installation instructions. Acceptable manufacturer for this item is Xexres Inc. or Edwards Fiberglass Incorporated.

2.4.1 Manufacturer Requirements - Shall provide the structural design and certification to the engineer for review. The design shall be in accordance with accepted engineering practice. Watertight fiberglass tanks of various capacities shall be installed at indicated location on plans. All tanks shall be structurally sound and watertight and shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.

2.4.2 Tank installation Media - Shall consist of washed creek rock or sand. Crushed stone is not acceptable.

Sand Requirements:

Type	Size
Sand	1.0-3.0mm effective size

uniform coefficient ≤3.0
fines ≤ 1%, fines smaller than .13mm

Washed Rock Requirements:

Nominal Size	Type
.50	Washed Creek Rock, 90% passing ¾" sieve, not more than 10% passing 3/8" sieve

2.5 Fencing - Shall be a minimum of five (5) feet in height, be made of woven wire with mesh small enough to prevent passage of small animals and children. The fence fabric shall be made of galvanized steel with a minimum wire size of #11 AWG before galvanizing, the cross-wire wires are to be secured by welding or twisting and have a maximum opening of 2"x 6" in the bottom 18". Standard Barbed wire shall be used. The posts for the fencing shall be either made of metal or appropriate CCA Pressure treated wood.

PART 3 - CONSTRUCTION

3.1 Construction

3.1.1 Filter Bed - The filter bed shall be built as indicated in the plans with the liner installed per manufacture instructions. The top layer in the filter bed shall consist of 4" of 0.50" to 3/4" washed creek rock. The second layer shall consist of 30" of 1.5 - 2.0 mm effective size rock with a uniformly coefficient of 1.5 to 2.5± and no more than 1% fines smaller than 0.13 mm. It is strongly recommended that the effective size detailed on the plans be adhered to. If the effective size of the gravel the Contractor proposes to use is outside the limits indicated on Plan Sheet 85 but still within the limits specified in these specifications, contact the engineer for advice on how to proceed. The third layer shall consist of 4" of rock as specified on Plan Sheet 85. The fourth (and bottom) layer shall consist of 8" of 0.5"-1.0" rock (3" of cover over drain line) placed on 2" of leveling sand. The rock shall be clean washed creek rock and well graded. There shall be a 4" SCH 40 slotted drain pipe at the bottom of the filter for the collection and removal of treated effluent. Slots are to be 4" apart minimum and 2" deep. The pipe is to be installed with one side of the slots resting on the bottom of the filter.

The pressure distribution system shall consist of a 2" PVC manifold and 1" PVC distribution lines. The manifold and distribution lines shall be SCH 40 PVC with holes as described in section 2.2 of these specifications. The 1" distribution lines shall be placed in the top layer of the filter bed and have 2" cover (0.5 nominal size rock).

3.2 Recirculation Tanks - Shall be installed according to the Manufacturers instructions. The tanks shall be anchored according to manufacturers instructions. (See included installation guide)

3.2.1 Installation and Testing – All fiberglass tanks shall have a twelve inch (12") minimum of sand bedding or select backfill material approved by the engineer when installed adjacent to a rock formation or as required by the manufacturer, whichever is the thicker of the two bedding requirements. All fiberglass tanks shall be filled with water upon installation (including backfilling) to avoid displacement. The Tank shall be tested for leaks before being put into service. The Tank shall be vacuum tested at manufactures location to verify structural integrity.

3.3 Pump Vault - Shall be equipped with pumps and all relevant appurtenances. The pumps are to be wired so that they operate off a timer under normal operation. A pump from each vault will run simultaneously. A timer override float shall be installed as indicated. A high water emergency alarm shall be installed as indicated. Another float set up may be submitted for review. (See included installation guides for pump vault and equipment).

3.4 Automatic Distributing Valves – Shall be installed so that they are located at the high point of the system and as close to the pump as possible. The valve shall be installed in a 30" dia PVC riser enclosure equipped with a fiberglass lid with insulation installed.

3.5 Fencing - The fence shall be installed in such a manner that the bottom nearly touches the ground. The posts shall be imbedded to a sufficient depth or otherwise securely anchored to prevent displacement and shall not be spaced more than 20' apart. The fencing shall be securely fastened to the posts with fasteners designed for the type of material used. At least two strands of barbed wire shall be provided above the fence fabric spaced no more than six inches apart. The fence shall be located to permit easy access for operation and maintenance. At least one (1) gate shall be provided for access of maintenance equipment. The gate shall be equipped so that a lock can be used to secure the gate. The gate shall be equipped so that a lock can be used to secure the gate and shall be of a material similar to the fencing.

3.5.1 Warning Sign - One warning shall be placed on each side of the facility fence and gate, so that they are clearly visible from all directions of approach. The minimum wording on the signs shall be "SEWAGE TREATMENT FACILITY – KEEP OUT." The characters shall be a minimum of two inches high. The signs are to be made of a durable material and shall be securely attached to the fence, equipment or gates.

3.6 Leak Testing – The recirculating sand filter system shall be tested for leaks before being put into service. The system shall be filled with clean water and operated at a 100% recycle setting for 24 hours. The engineer shall be present for the initial filling of the system and at the 24 hour review of the system to check the static level of water in the system.

END OF SECTION

PART I - ACCESS RISERS

To provide maximum installation flexibility and eliminate the need for confined space entry equipment, optional riser assemblies shall be provided. Adjustable access risers will allow direct burial of the tablet feeder and will accommodate direct connection to existing system piping. Each riser shall be molded polyethylene with a nominal height of 24" and adjustable in 6" vertical increments via trim lines molded into each riser section. Risers shall utilize the same molded cover as the tablet feeder body. Each riser section shall contain transverse reinforcing struts and synthetic drive rivets at each joint to allow for direct burial. The reinforcing struts shall be constructed of fiberglass reinforced plastic with a 1" outside diameter and molded nylon couplings on each end. Each strut shall be held in position by an integrally molded retaining boss. Molded drill points shall be provided to locate the drive rivets in the riser assembly. One tube of Bio-Dynamic sealant shall be supplied with each riser section and shall be used to seal each riser joint internally and externally to insure watertight integrity.

Bio-Dynamic Tablet Feeder Data Chart

Model	Inlet/Outlet Diameter	Minimum Flow (GPD)	Design Flow (GPD)	Maximum Flow (GPD)	Number of Tubes	Fixed Wier	Adjustable Sluice	Drawing Number
XT 2000 (S)	4"	200	20,000	100,000	2	Standard	Optional	PC-5-9501
IT 2000 (S)	4"	200	20,000	100,000	2	Standard	Optional	PC-5-9500
ITR 2000-S	4"	200	20,000	100,000	2	Not available	Standard	PC-5-9502
XT 4000 (S)	6"	20,000	50,000	200,000	4	Standard	Optional	PC-5-9503
IT 4000 "(s)	6"	20,000	50,000	200,000	4	Standard	Optional	PC-5-9504
ITR 4000-S	6"	20,000	50,000	200,000	4	Not available	Standard	PC-5-9505

END OF SECTION

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of providing all labor, materials, equipment, and services required for completion of all electrical work as shown on the drawings and specified herein.

1.3 The Contractor shall be responsible for all of his work, fitted into place in a satisfactory and neat workmanlike manner in every particular to the approval of the Engineer.

1.4 Confer with the Contractor regarding the location and size of pipes, equipment, fixtures, conduit, ducts, openings, switches, outlets, etc., in order that there be no interferences between the installation of the various trades items on the project. The Architectural Drawings shall take precedence over the Electrical Drawings.

1.5 The Electrical Drawings are diagrammatic and shall be followed as closely as actual construction of the building and the work of other trades will permit. All changes from Drawings necessary to make the work of each trade conform to the building construction and the work of the other trades shall be done at the Contractor's expense.

1.6 The Owner reserves the right to change the location of any equipment five (5) feet and any piping or conduit ten (10) feet in any direction without extra charge, provided such changes are made before installation.

1.7 Unless explicitly stated to the contrary,the Contractor shall furnish and install each item of equipment or material hereinafter specified, complete with any and all necessary fittings, supports, trim, piping, insulation, etc., as required for a complete and operating installation.

1.8 All equipment and materials shall be installed according to the manufacturer's instructions unless otherwise specifically directed by the Contract Documents.

PART 2 - STANDARDS, LAWS AND ORDINANCES

2.1 Supplementing the requirements of the General Conditions for compliance with laws and ordinances, the work shall meet or exceed the requirements of the following:

2.1.1 Electrical Equipment and Wiring - National Electric Code

2.1.2 Heat Producing Appliances - BOCA Code

2.2 All products and equipment shall meet UL requirements. Contract Documents shall govern whenever they exceed applicable code requirements.

PART 4 - OPENINGS AND SLEEVES IN CONSTRUCTION

4.1 The openings required in wall, floor, roof, ceiling, etc., construction for Electrical work will be provided by the Contractor. All sleeves, inserts, forms, etc., required for openings shall be furnished by the Contractor. The Contractors shall be responsible for their size, fabrication and location.

4.2 Sleeves shall be provided wherever pipes or electrical conduit pass through walls or floors. In placed concrete or masonry, sleeves shall be Schedule 40 PVC pipe. Sleeves in foundation walls shall be Schedule 40 steel pipe. In most other locations, sleeves may be 20 gauge galvanized sheet metal.

PART 5 - EXCAVATION AND BACKFILLINGS

5.1 The Contractor shall do all excavating, sheeting, bracing, and backfilling required for the installation of any and all parts of his respective work. Each bidder shall visit the premises and determine for himself, at his own expense, by actual observation, boring or other means, the nature of the soil condition. Excavate solid rock or in ground water conditions at no increase in contract price, except as specified in the Contract Documents.

5.2 Piping, conduit, etc., shall be bedded firmly and continuously on undisturbed earth (or sand or pea gravel where specified or required). Where piping has bells, excavate deeper at same.

5.3 Where the excavation is in rock, ashes, cinders, refuse or other unsuitable materials, make the trench 6" deeper and 12" wider than required for the piping and backfill with approved sand or pea gravel 6" deep. In these areas provide 6" sand or pea gravel backfill around entire perimeter of pipe, conduit, etc.

5.4 Maintain all trenches and excavations free of standing water. DO NOT backfill any trench until pressure tests have been completed, the joints and pipe have been found to be water-tight, and the Engineer, Electrical Inspector, etc., have approved same. Backfill all trenches in 8" layers and compact by tamping and puddling. Backfill material shall not be frozen.

5.5 Backfill for the first 12" over piping etc., shall be placed by hand and carefully tamped.

5.11 Whenever excavations are made through existing grassed areas, Contractor shall seed or sod to match existing.

5.12 Before beginning excavation work Contractor shall contact utility companies and request that they locate and stake buried piping, wiring, etc. Such piping, wiring, etc., shall be exposed by hand excavation prior to the use of power equipment.

PART 7 - WIRING OF MECHANICAL EQUIPMENT AND MOTORS

7.1 Unless otherwise specified, the Contractor will furnish and install all conduit, wiring, disconnects, starters, thermal overload heaters, holding coils, remote push-button stations, hand-off-auto and multi-speed switches, and pilot lights for all electrically operated-mechanical equipment, including final connections to same, as shown on the drawings and as hereinafter specified, leaving same ready for operation.

7.2 The contractor shall coordinate the motor type, voltage, and size with the starter type, voltage and size, holding coil voltage, thermal overload capacities, interlocks, etc., and shall be equally responsible to insure that the equipment installed is of proper size and type.

7.3 After wiring is completed, the Contractor shall inspect said wiring before motors are operated. If any discrepancies are discovered, notify the Engineer in writing of said discrepancies. The Engineer will arrange to have changes executed as required. After any required changes are complete, the Contractor shall assume complete responsibility for motor protection during the warranty period including initial start-up of each motor.

PART 9 - OWNER INSTRUCTION

9.1 It shall be the responsibility of the Contractor to furnish all testing equipment and labor necessary to perform the following tests:

9.2 After wires or cables are in place, but before being connected to devices and equipment, the system shall be tested for shorts, opens, intentional and unintentional grounds by means of an approved type of constant "Megger". All hot wires in conduit that shorted or unintentionally grounded shall be replaced.

9.3 A voltage test shall be made on the last outlet of each branch circuit and the potential drop shall not exceed 2%. Voltage drops for panel and large feeders shall not exceed 3% hence the total voltage drop for a feeder and any branch circuit shall not exceed 5% of the service voltage. The test shall be made under design load, or its equal.

9.4 Test the insulation resistances of all motor windings to ground with a "Megger" before applying line voltage to the motors. If these values are less than 1 megohm,the Contractor furnishing the motor shall be responsible for correcting the error.

9.5 With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate plus or minus 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.

9.6 Any wiring device, lighting fixture, or electrical apparatus in this contract, if grounded or shorted on an integral "line" part, shall be removed and the trouble corrected.

PART 11 - IDENTIFICATION

11.1 All equipment, such as panels, cabinets, etc., furnished by the Contractor shall be permanently labeled, in an approved manner, corresponding to the mark and name shown on the drawings and/or in the specifications. Label shall include the name of the Contractor.

11.2 All wire and cable shall be color coded and shall be labeled with tags or tape at each end giving use and circuit number (see wire and cable).

11.3 All devices controlling equipment such as TT switches, disconnects, starters, time switches, special light switches, dimmers, etc., shall be clearly labeled as to what they control.

11.4 All special outlets and/or receptacles rated over 120 volts or whose use is not clear to the layman shall be labeled (i.e.208V-3-30A, etc.)

PART 12 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

12.1 Contractor shall demonstrate the use and essential features of the installed Electrical Systems.

12.2 Each system shall be demonstrated once only, after completion of testing and acceptance.

12.3 The demonstration shall be held upon completion and acceptance of all systems at a date and time to be agreed upon in writing by the Owner or his representative.

12.4 The demonstrations shall be held by the Contractor in the presence of the Owner, and/or his representative and the manufacturer's representative if required by the Owner.

12.5 Demonstrate the function and locations (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.

12.6 Demonstrate by "start-stop operations" how to operate the controls, how to reset protective devices, how to replace fuses and what to do incase of emergency.

12.7 Submit a certificate of completed demonstration countersigned by the Owner.

PART 13 - CONCRETE WORK AND PADS

13.1 All concreting, reinforcing, and form work necessary in connection with the construction of pads and the concreting around raceway runs underground shall be provided by the Contractor. Refer to Concrete Division for Concrete forms, materials and other requirements.

PART 14 - FINAL INSPECTION

14.1 Final inspection will be made only after the Contractor certifies in writing that the work is 100% complete.

14.4 At the final inspection, the covers of all panels and main switch gear shall be removed for inspection. The cover removal shall be done in the presence and at the request of the Engineer or his representative.

PART 15 - PROJECT CLOSEOUT REQUIREMENTS

15.1 The following requirements must be fully completed before the final application for payment will be accepted or approved.

15.1.1 Final Inspection

15.1.2 Final Submittals - Submit the following to the Owner (list is not necessarily all inclusive):

a. Maintenance Manual(s.)
b. Owner Instruction Certification Letters.
c. Manufacturer's Letters of Certification.
d. Extended Guarantees (for specific equipment with more than a one (1) year guarantee).
e. Written receipt signed by Owner for ALL loose items turned over to Owner such as:
   Electrical panel keys
   Extra air filters
   Special wrenches, tools, etc.

END OF SECTION

Recirculating Sand Filter Design Selection

Loaded at 5 gpd/ft²

RSF Design	Design Flow (gpd)	Filter Size (W' x L')	Cells	Zones Per Cell	Laterals Per Cell	Lateral Length	Orifices Per Lateral	Orifices Per Zone	Design Flow Rate (gpm)	Typical Pump Series	Distributing Valve Model
RSF-1K-1	1,000	4x50	1	1	2	49	25	50	22	(2) P30	N
RSF-1K-2	1,000	8x26	1	1	4	25	13	52	22	(2) P30	N
RSF-1.5K-1	1,500	8x38	1	1	6	37	19	76	33	(2) P30	N
RSF-2K-1	2,000	8x50	1	1	4	49	25	100	43	(2) P50	N
RSF-2K-2	2,000	16x26	1	1	8	25	13	100	45	(2) P50	N
RSF-2.5K-1	2,500	12x42	1	2	6	41	21	63	27	(2) P30	N
RSF-3K-1	3,000	12x50	1	2	6	49	25	75	32	(2) P30	N
RSF-3K-2	3,000	12x50	1	2	6	49	25	75	32	(2) P30	V6402A
RSF-3.1K-1	3,100	24x26	1	2	12	25	13	78	34	(2) P30	N
RSF-3.1K-2	3,100	24x26	1	2	12	25	13	78	34	(2) P30	V6402A
RSF-3.5K-1	3,500	16x44	1	2	8	43	22	88	38	(2) P50	N
RSF-4K-1	4,000	16x50	1	2	8	49	25	100	43	(2) P50	N
RSF-4K-2	4,000	16x50	1	2	8	49	25	100	43	(2) P50	V6402A
RSF-4.1K-1	4,100	32x26	1	2	16	25	13	104	45	(2) P50	N
RSF-4.1K-2	4,100	32x26	1	2	16	25	13	104	45	(2) P50	V6402A
RSF-4.6K-1	4,600	20x46	1	2	10	45	23	115	49	(2) P50	N
RSF-4.6K-2	4,600	20x46	1	2	10	45	23	115	49	(2) P50	V6402A
RSF-5K-1	5,000	20x50	1	2	10	49	25	125	54	(2) P50	N
RSF-6K-1	6,000	24x50	1	2	12	49	25	75	32	(2) P30	V6404A
RSF-7K-1	7,000	32x44	1	4	16	43	25	100	43	(2) P50	V6404A
RSF-8K-1	8,000	32x50	1	4	16	49	25	100	43	(2) P50	V6404A
RSF-9.2K-1	9,200	40x46	1	5	20	45	23	92	40	(2) P50	V6605A
RSF-10K-1	10,000	40x50	1	5	20	49	25	100	43	(2) P50	V6605A
RSF-12K-1	12,000	48x50	2	4	12	49	25	75	32	(4) P30	(2) V6404A
RSF-14K-1	14,000	64x44	2	4	16	43	22	88	38	(4) P50	(2) V6404A
RSF-15K-1	15,000	60x50	2	5	15	49	25	75	32	(4) P30	(2) V6605A
RSF-16K-1	16,000	64x50	2	4	16	49	25	100	43	(4) P50	(2) V6404A
RSF-18.4K-1	18,400	80x46	2	5	20	45	23	92	40	(4) P50	(2) V6605A
RSF-20K-1	20,000	80x50	2	5	20	49	25	100	43	(4) P50	(2) V6605A
RSF-25.9K-1	25,900	108x48	3	6	18	47	24	72	31	(6) P30	(3) V6606A
RSF-30K-1	30,000	120x50	3	5	20	49	25	100	43	(6) P50	(3) V6605A
RSF-36.8K-1	36,800	80x92	4	5	20	45	23	92	40	(8) P50	(4) V6605A
RSF-40K-1	40,000	80x100	4	5	20	49	25	100	43	(8) P50	(4) V6605A
RSF-45K-1	45,000	90x100	6	5	15	49	25	75	32	(12) P30	(6) V6605A
RSF-51.8K-1	51,800	108x96	6	6	18	47	24	72	31	(12) P30	(6) V6606A

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Sand Gradation Range for Recirculating Sand Filter Media Loaded up to 5 gpd/ft^2* (D_{10} = 1.5 to 2.5 mm; Cu = 1 to 3)

* Follow complete Recirculating Sand Filter design criteria.

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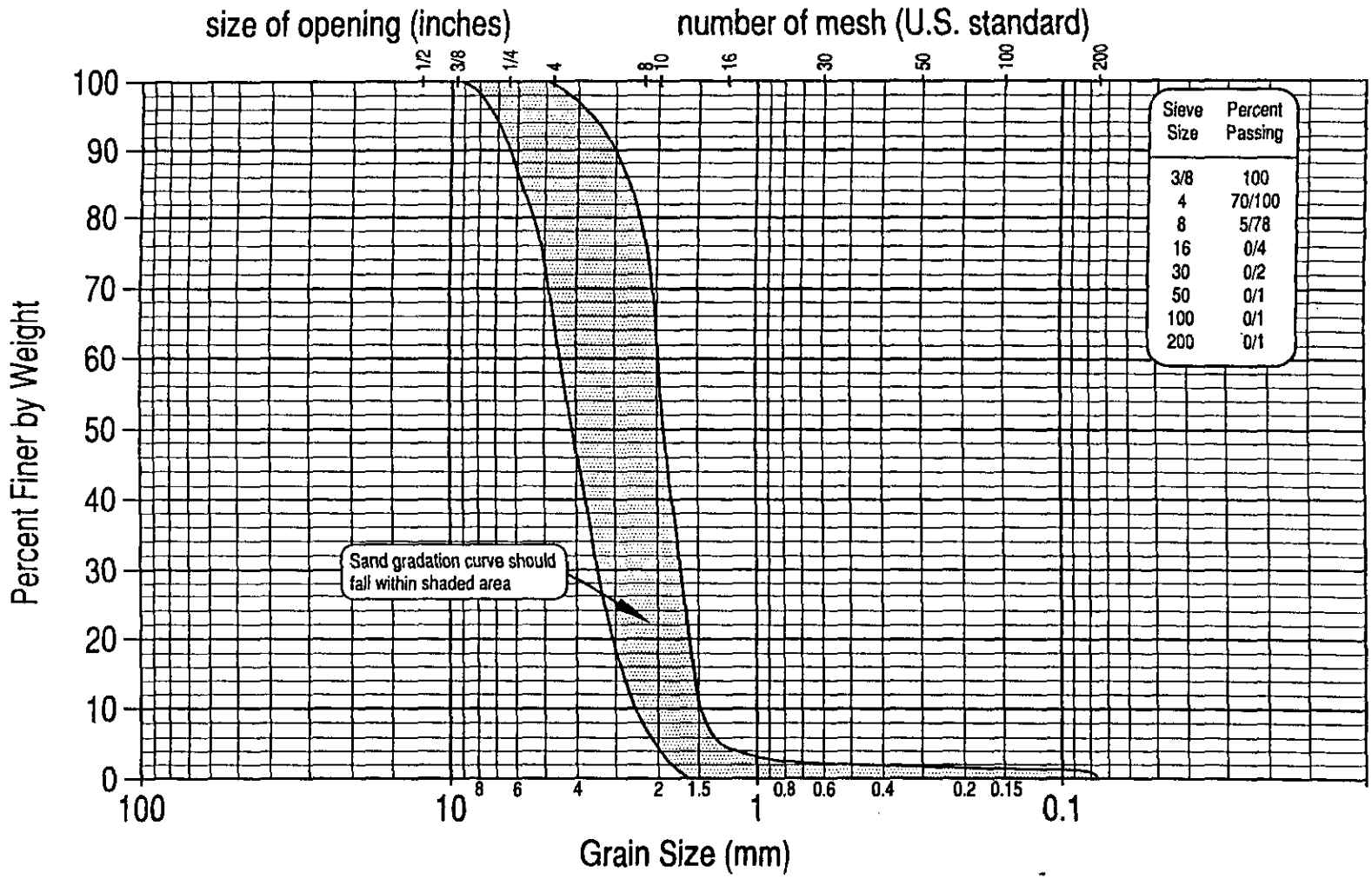

Note: To ensure the sand consolidates sufficiently, keep it wetted while placing.

APPENDIX 5

FEASIBILITY STUDY
WATER SYSTEM

1. Specifications for the utility system - See Exhibit B.

2. Estimated cost of the construction during the first three years of construction - $257,023.00.

3. Plans for financing - Loan from Four J Land And Cattle Company.

4. Proposed rates and charges - Highway H initially plans to provide service in accordance with its currently approved tariffs, which are on file with the Public Service Commission. However, as Highway H has not sought an increase since these rates were put into effect in 1990, it is likely that Highway H will request a rate increase at some point in the future.

5. Estimate of the number of customers, revenues and expenses during the first three (3) years of operations -

   A. Highway H believes that the 117 "buildable" lots will be sold within four (4) years and that homes will be built, and a customer on each of those 117 lots within four (4) years.

   B. It is estimated that the average customer will utilize gallons per month resulting in $10.50 per customer per month, or, annual revenues of $14,742.00 for the area proposed to be certificated on a going forward basis.

   C. Estimated annual operating expenses for the area proposed to be certificated are as follows:

Category	**Amount**
Reading & Billing	$2,808.00 ($2.00 per read)
Electric	$3,000.00
Office Expenses	$2,000.00
Taxes & Insurance	$2,000.00
Labor	$2,000.00

D. Revenues v. Expenses for the first three years:

	Year 1	Year 2	Year 3
REVENUES	$5,159.70	$10,319.70	$14,742.00
EXPENSES			
Operating Expenses	$5,960.00	$8,420.00	$9,808.00
Property Tax	$500.00	$500.00	$500.00
TOTAL EXPENSE	$6,460.00	$8,920.00	$10,308.00

TECHNICAL SPECIFICATIONS

FOR

PROPOSED WATER SUPPLY SYSTEM

FOR

NORTHERN HEIGHTS ESTATES SUBDIVISION

FOR

4J LAND & CATTLE COMPANY
P.O. BOX 308
WAYNESVILLE, MISSOURI 65583

BY

ANDERSON
& ASSOCIATES
Consulting Engineers, LLC

1511 Watts Drive ❖ P.O. Box 806
Rolla, Missouri 65402-0806

JANUARY 2004
AA1785

EXHIBIT B

TABLE OF CONTENTS

1. INDEX OF DRAWINGS

The drawings referred to and accompanying these specifications consist of the following sheets:

DRAWING NUMBER	DESCRIPTION
1	ROADS A & B, PLAN & PROFILE
2	ROADS C & D, PLAN & PROFILE
3	ROADS E, F & G, PLAN & PROFILE
4	WELLHOUSE PLANS
5	PRESSURE TANK HOUSE PLAN
6	SITE DETAILS, WATER

END OF SECTION

GENERAL CONDITIONS

GC-1 NOTICE

a) The General Conditions, Special Conditions, all other sections of the specifications, and all other herein bound documents are part of this section and of the Contract. Before submitting Proposals, bidders should read all the above mentioned documents and familiarize themselves with all requirements of same. Submission of Proposal implies that the bidder is fully conversant with all requirements of all said documents. No claim for additional compensation will be considered or paid on account of the Contractor's neglect or failure to be so informed.

b) Before submitting Proposals, bidders should visit the site(s) of the proposed work, verify all site conditions and also conditions under which said work must be conducted. Submission of Proposal implies that the bidder is fully conversant with all such conditions. No claim for additional compensation will be considered or paid on account of the Contractor's neglect or failure to be so informed.

GC-2 DEFINITIONS

a) Acceptance: The formal written acceptance by the Engineer of the Contract which has been completed in all aspects in accordance with the Drawings, Specifications and all Contract Documents and any modifications thereof previously approved.

b) Act of God: An earthquake, flood, cyclone, or other cataclysmic phenomenon of nature. Rain, wind, or other natural phenomenon of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the Contractor for damages to the work resulting therefrom.

c) "Approved", "Proper", "As Directed", "As Instructed", and "As Selected": As used throughout these specifications and other Contract Documents mean the approvals, directions, instructions, and selections by the Engineer are required, unless otherwise clearly stated.

d) Bidder: Any individual, partnership, corporation, or combination thereof, submitting a proposal for the performance of the Contract, acting directly or through a duly authorized representative.

e) Contract: The agreement covering the performance of the work described in the Contract Documents including all supplemental agreements thereto and all general and special provisions pertaining to the work or materials thereof.

f) Contract Documents: The Contract Documents consist of the Notice to Contractors, Instruction to Bidders, Bid Proposal, Contract Agreement, Bid Bond Performance Bond, General Conditions, Special Conditions, Detailed Specification Requirements, Drawings, and any addenda thereto; also any supplemental drawings by the Engineer, those working Drawings submitted by the Contractor as approved by the Engineer, including any manufacturer's Drawings of equipment for permanent installation in this project; also any and all supplemental agreements amending or extending the work contemplated and which may be required to complete the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations, amendments or extensions of the Contract and include contract change orders. All these documents are complementary to, and explanatory of each other, and each and every one of these documents is a part of the Contract.

g) Contractor: The person, partnership, corporation, or combination thereof, private or municipal, or his or their lawful representatives, who have entered into a contract with the Owner.

h) Contract Time: The time allowed for the completion of the work computed in consecutive calendar days from the date of notice to the Contractor to commence work.

i) Days: Calendar days, unless otherwise designated.

j) Drawings: All drawings listed in the Index of Drawings and any addenda thereto, all supplemental drawings, working drawings and revisions to same, or exact reproductions thereof, as prepared or approved by the Engineer and officially given to the Contractor.

k) Engineer: Anderson and Associates, Consulting Engineers, acting either directly or through properly authorized representatives, such representatives acting within the scope of the responsibilities and authority delegated to them. Mention is made of them throughout the Contract Documents as though each is of singular number and masculine gender.

l) Inspector: Any authorized representative of the Engineer or Owner assigned to make any and all necessary inspections of the work and materials furnished by the Contractor, and his authority definitely restricted to these functions.

m) Owner: The term "Owner", as used throughout these Specifications means: government bodies, including municipalities, corporations, partnerships, or individuals designated as Owner in the Agreement and throughout the Contract Documents.

n) Notice: The provision in any of the Contract Documents regarding the giving of any notice implies that the notice has been given, as to the Owner: when written notice has been delivered to the Engineer, or has been placed in the United States' Mail addressed to the Owner's chief executive officer; as to the Contractor: when written notice has been delivered to the Contractor's chief at the project site, or by placing such written notice in the United States' Mail addressed to the Contractor at the place stated in the papers prepared by him to accompany his proposal as the address of his permanent place of business; as to the Surety on the Performance Bond: when a written notice is placed in the United States' Mail addressed to the Surety at its home office, or to its agent or agents who executed such Performance Bond on behalf of said Surety.

o) Performance Bond: The approved form of security furnished by the Contractor and his Surety as a guaranty of good faith on the part of the Contractor to execute the work in accordance with the terms of the Contract.

p) Proposal: The offer of a Bidder to perform the work described by the Contract Documents when made out and submitted on the prescribed Proposal Form, properly signed and guaranteed.

q) Proposal Guaranty: The cashier's check or Bidder's Bond accompanying the Proposal submitted by the Bidder, as a guaranty that the Bidder will enter into a Contract with the Owner for the construction of the work, if the Contract is awarded to him.

r) Provide: The word "provide" as used throughout these Specifications and other Contract Documents, means that the Contractor shall provide the required labor, services, equipment, tools, transportation; and, the Contractor shall also provide the specified materials, accessories, work, equipment, furnishings, transportation, and other required items in place, complete, unless definitely specified otherwise.

s) Site of the Work: The area to be occupied by the project and all adjacent areas and other related areas occupied or used by the Contractor or his subcontractors during the performance of the work, including areas for the production, procurement, storage and disposal of earthwork, concrete and paving materials, and similar materials.

t) Specifications: The Specifications shall include the Invitation to Bid, Instruction to Bidders, Bid Proposal, Contract Agreement, Bid Bond, Performance Bond, General Conditions, Special Conditions and the Detailed Specification Requirements, including all modifications thereof and all addenda thereto.

u) Subcontractor: Any person, firm, or corporation with a direct contract with the Contractor who acts for or in behalf of the Contractor in executing any part of the Contract, including one who furnishes material worked to a special design according to the Drawings or Specifications of this work, but not including one who merely furnishes material not so worked.

v) Surety: The person or persons, firm or firms, or corporation or corporations which execute the Contractor's Bid Bond and/or Performance Bond and/or Labor and Materials Payment Bond.

w) The Work: All the facilities specified, indicated, shown or contemplated by the Contract as comprising and necessary for the completion of the project, including any portions of such facilities furnished to the Contractor by the Owner or the Engineer, and, except as otherwise expressly provided in the Specifications, the provision and furnishing by the Contractor of all materials, equipment, labor, methods, processes, construction and manufacturing materials and equipment, tools, plants, supplies, power, water, transportation, and other things necessary to complete such facilities in accordance with the Contract.

x) Work: As used throughout the Contract Documents, the term "work" of the Contractor or Subcontractor, implies the furnishing of materials or labor or both.

y) Reasonable Time: The words "reasonable time", as used throughout the Contract Documents, mean: " not over ten (10) days from receipt of notice".

z) Common Usage: Words having usual, customary, well known trade or technical meanings imply such meanings as used throughout the Contract Documents.

GC-3 ABBREVIATIONS

Certain abbreviations, as used throughout these Specifications and other Contract Documents, mean:

AASHTO	-	American Association of State Highway & Transportation Officials
ACI	-	American Concrete Institute
ADA	-	Americans with Disabilities Act
AIA	-	American Institute of Architects
AISI	-	American Iron and Steel Institute
AISC	-	American Institute of Steel Corporation
ASA	-	American Standards Association (Now USASI - United States of America Standards Institute)
ASHRAE	-	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWS	-	American Welding Society

AWPA	-	American Wood Preservers' Association
IEEE	-	Institute of Electrical and Electronics Engineers
NBFU	-	National Board of Fire Underwriters
NCPI	-	National Clay Pipe Institute
NEC	-	The National Electrical Code
NEMA	-	The National Electrical Manufacturers' Association
NFPA	-	National Fire Protection Association
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
UL	-	Underwriter's Laboratories
USAS	-	United States of America Standards Institute (Formerly ASA-American Standards Association)

GC-4 THE CONTRACT DOCUMENTS

a) The Agreement, the General Conditions, the Special Conditions, the Drawings, the Specifications, including all addenda issued prior to the execution of the Agreement, taken together form the Contract.

b) The Contractor and the Owner shall sign the Contract Documents in not less than duplicate; in case the above fail to sign the General Conditions, Special Conditions, Drawings, or Specifications, the Engineer will identify them.

c) The work in this Contract includes the furnishings of all materials, accessories, equipment, expendable equipment, tools, utilities, transportation, services, labor, and other items of work reasonably incidental thereto, and performance of all operations, as required to completely execute all work for this project, and to outline items or work which cannot be readily shown on the Drawings; and to further indicate types and quality. The Drawings and Specifications are cooperative and contiguous; items and work mentioned or indicated in one and not the other shall be included, provided, supplied, and performed as though fully covered by both. It is not intended that work not specified in or inferable from any section, class, or trade of the Specifications shall be provided unless shown on the Drawings.

d) Unless otherwise definitely noted on Drawings or so specified in these Specifications, the Contractor shall provide all work for this project in place complete.

e) For convenience of reference and to facilitate awarding of the Contract, these Specifications are separated into titled sections. Such separated shall not operate to make the Engineer an arbiter, to establish limits to the Contract between the Contractor and subcontractor. Nothing in the Contract Documents shall create any contractural relationship between the Owner and any Subcontractor.

f) In case of apparent disagreements in the Drawings or Specifications, either within themselves or with each other, Contractors shall estimate on and provide the greater quantity or better quality, unless otherwise directed by the Engineer.

GC-5 DRAWINGS, SPECIFICATIONS, AND INSTRUCTIONS

a) All work for this project shall be executed by the Contractor in accordance with all requirements of the Drawings, Specifications, Contract Documents and such additional instructions, detail Drawings or otherwise, furnished (reasonable promptly) by the Engineer for the proper execution of such work. Develop all detail Drawings properly, consistently and correctly from the Contract Documents. The Contractor shall not execute work without the proper Drawings and

interpretation thereof. Figured dimensions shall have preference over scale measurements and large scale Drawings over small scale Drawings.

b) All addenda, modifications, and amendments to the Drawings and Specifications, supersede all contrary or conflicting information on or in same.

c) If either the Engineer or the Contractor so requests, they may jointly set up a schedule establishing dates on which the detailed Drawings are required. The Engineer will furnish the Drawings on the established dates.

d) Immediately after award of Contract, the Contractor shall submit to the Engineer a progress schedule, fixing dates for the manufacture, installation, and completion of the entire project. The Contractor shall adhere strictly to the progress schedule, as approved by the Engineer.

e) Unless otherwise provided or so specified in the Contract Documents, the Engineer will furnish gratis to the Contractor, ten (10) copies of Drawings he may require for execution of the work.

f) The Contractor shall keep on the site of work, available to the Engineer, one (1) complete stamped and approved set (in good condition) of all Drawings and Specifications.

g) All Drawings, Specifications, and copies of same furnished by the Engineer are and remain his property. They shall not be used on other work but shall be returned to him upon completion of the work on this project.

GC-6 OWNERSHIP OF DOCUMENTS

All Drawings, Specifications, and copies thereof furnished by the Engineer are his property. They are not to be used on other work, and with the exception of the Contract Set, are to be returned to him on request, at the completion of the work.

GC-7 CONTRACTOR'S WORKING OR SHOP DRAWINGS

a) The Contract Drawings shall be supplemented by the Contractor with working Drawings as may be required for the prosecution of the work and approval of equipment. Working Drawings include shop detail Drawings, fabrication Drawings, erection Drawings, reinforcing bar placing Drawings, false-work and form-work Drawings, pipe layouts and similar classes of Drawings, which shall be approved by the Engineer before any work involving these Drawings is performed. No change shall be made by the Contractor in any working Drawing after it has been approved by the Engineer.

b) Working Drawings shall be submitted to the Engineer for approval before commencing work and in ample time to permit the satisfactory process of the work.

c) The sequence of submission of working Drawings shall be such that all information is available to the Engineer for review of each Drawing as it is received. One (1) transparent print and two (2) prints of each working Drawing shall be submitted. One (1) transparent print of each Drawing will be returned to the Contractor marked "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", or, "Rejected -- See Remarks", within twenty (20) calendar days after receipt. The Contractor shall make necessary corrections and revisions to Drawings returned marked "Make Corrections Noted", "Amend and Resubmit", or, "Rejected -- See Remarks", and

shall resubmit the Drawings in the same routing as before within twenty (20) calendar days after receipt. Responsibility will be upon the Contractor to furnish Drawings in sufficient time for approval action, including resubmittal, without delaying construction.

d) All working Drawings, shop Drawings, schedules, and illustrations shall be submitted through the Contractor and not directly by Subcontractors, suppliers, and manufacturers. The Contractor shall be responsible for the coordination of all shop drawings required for the work.

e) The Contractor shall, at his own expense, make such changes in the above Drawings as may be found necessary upon inspection by the Engineer to make the same conform to the Specifications or to the layout. Prior to approval of any such Drawings, any work which the Contractor may do on the equipment covered by the same shall be at his own risk, as the Owner will not be responsible for any expense incurred by the Contractor in changing equipment to make the same conform to the Drawings as finally approved.

f) The Contractor shall prepare all working, shop, erection, and equipment Drawings at proper scale, full dimension and showing in detail the design, construction, finishes, metal gauges, operating devices (if any), anchorage, installation requirements, and all other pertinent information required for complete fabrication, assembly installation of all the required work.

g) The Contractor is responsible for the accuracy of all dimensions and for all materials and their conformity to the Contract Documents and the Contract. He shall check (promptly) all shop Drawings and other data, and note corrections on same prior to their submittal to the Engineer.

h) When submitting shop Drawings, the Contractor shall mention in his letter of transmittal, proposed deviations (if any) from Drawings and Specifications requirements.

i) Working Drawings will be subject to approval insofar as the details affect the character of the finished work, but details of design will be left to the Contractor who shall be responsible for the successful construction of the work. It is expressly understood, however, that approval of the Contractor's working Drawings shall not relieve the Contractor of any responsibility for accuracy of dimensions and details, or for mutually agreed that the Contractor shall be responsible for agreement and conformity of his working Drawings with the Contract Drawings and Specifications.

j) In the case of minor equipment for which Drawings may not be required, the Contractor shall furnish to the Engineer a tabulated list, from time to time, showing the name of the manufacturer and the catalog number of the type of equipment proposed, together with such prints, dimensions, specifications, samples, or other data as may be required to permit intelligent judgement of the acceptability of the equipment proposed.

k) Upon approval of the above Drawings, lists, prints, samples, and other data, the same shall become a part of the Contract and the equipment furnished shall be in conformance with the same, provided that the approval of the above Drawings, lists, prints, specifications, samples, or other data shall in no way release the Contractor from the responsibility for the proper fulfillment by any equipment of the requirements of the Contract and of the purpose for which said equipment is installed nor from his liability to replace the same should it prove defective.

l) The Contractor shall provide additional copies of shop Drawings when requested by the Engineer.

m) The Contractor shall keep on site of the work at all times a complete, up-to-date, stamped, approved set of shop drawings available to the Engineer.

n) The cost of furnishing all working Drawings shall be included in the Contract Prices to which the Drawings are pertinent.

GC-8 CONFORMITY WITH DRAWINGS AND ALLOWABLE DEVIATIONS

Finished work in all cases shall conform with the lines, grades, cross-sections and dimensions shown on the approved Drawings furnished by the Engineer. Deviations from the Drawings as may be required by the exigencies of construction will be determined by the Engineer.

GC-9 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

Should it appear that the work to be done or any part of the matters relative thereto are not sufficiently detailed or explained in the Drawings or Specifications, the Contract shall apply to the Engineer for such further explanations as may be necessary and shall conform to them as part of Contract. Any questions regarding the true meaning of the Drawings or Specifications shall be directed to, and decided by the Engineer.

Whenever reference is made to a specification of ASTM, AWWA, or any other authority and the number accompanying the specification representing the year of its acceptance or adoption is omitted, the reference shall mean the specification in effect on the date of the Invitation Bid.

GC-10 ENGINEER'S STATUS

a) The Engineer is the Owner's representative during the construction period, and he shall observe the work in progress on behalf of the Owner. The Engineer has authority to act on the Owner's behalf only to the extent stipulated in the Contract Documents or otherwise by Owner's signed authority, which shall be shown to the Contractor. He has authority to stop the work whenever, in his opinion, it is necessary to do so in order to ensure proper agreement with the Plans and Specifications. The Engineer is the interpreter of the conditions of the Contract and the judge of its performance, and shall side with neither the Owner nor the contract, but shall exercise his powers under the Contract to enforce its faithful performance by both.

b) The Engineer shall render decisions on all claims of the Owner or Contractor, and on all other materials pertaining to the execution and progress of the work or interpretations of the Contract Documents, within ten (10) days after his receipt of written notice of same.

c) The decisions of the Engineer (subject to arbitration as specified in Article GC-11) shall be final, and the signing of the Contract implies the Contractor's agreement to accept the Engineer's decision as final in all such matters as require architectural and engineering decisions, such as quality of workmanship, suitability of materials for work, performance of equipment, fulfillment of guarantees thereon, and artistic effect.

d) In case the Engineer does not render a decision within ten (10) days after both parties have presented their evidence, either party may then demand arbitration.

e) The Engineer's failure to detect imperfections in the work or materials, or failure to notify the Contractor when to start, cease and to resume work shall in no way operate as a waiver of the Owner's rights to the specified standard of workmanship and materials and to efficient and prompt conduct (by the Contractor) of the work.

GC-11 ARBITRATION

a) All disputes, claims, or questions subject to arbitration under this Contract may be submitted to arbitration upon written notice of either party to the Contract and a copy of same filed with the Engineer. The demand for arbitration shall be made within a reasonable time after the dispute has arisen and shall not be made later than the time of final payment unless otherwise expressly stipulated in the Contract. When arbitration is demanded, the Owner and the Contractor shall each appoint an arbitrator, and the two thus appointed shall appoint a third arbitrator. If the first two arbitrators cannot agree upon a third within thirty (30) days from the date of their own appointment, the third arbitrator shall be appointed by the circuit judge having jurisdiction in the county within which the work is being performed. No person with a financial interest in the subject under arbitration is eligible to act as arbitrator.

b) The Contractor shall not cause a delay of the work during any arbitration proceedings, except by signed agreement with the Owner. It is hereby mutually agreed that the arbitrators' decision shall be a condition precedent to any right of legal action that either party may have against the other.

c) The arbitrators may award to the party whose contention is sustained such sums as they or a majority of them shall deem proper to compensate him for the time and expense incident to the proceedings and, if the arbitration was demanded without reasonable cause, they may also award damage for delay.

1. Judgement (under prevailing arbitration law) upon the award rendered may be entered in the court of the forum, State or Federal, having jurisdiction.

d) The arbitrators may engage experts to act in an advisory capacity, but without votes. The arbitrators shall fix their own compensation, unless otherwise provided by agreement, and shall assess the costs and charges of the proceedings upon either or both parties.

GC-12 INSPECTION

a) The Owner, the Engineer, and his representative shall have access at all times to the work whenever it is in progress or in preparation for the purpose of inspection. The Contractor shall provide proper, adequate facilities for such inspection.

b) If any work be covered up without approval or permission of the Engineer, it shall if directed by him, be uncovered for examination at the Contractor's expense and without extra cost to the Owner.

c) The Engineer may order re-examination of questioned work; if so ordered, the Contractor shall uncover same. If uncovered work conforms to requirements of the Contract Documents, the Owner shall pay the cost of re-examination and replacement. If questioned work does not conform to requirements of the Contract Documents, the Contractor shall pay the cost, including cost of replacing defective work, without extra cost to the Owner.

d) When the Contractor has completed the work in this Contract, the Owner, the Engineer, or his representatives, will make a final inspection of the work to determine its conformity to the Drawings, Specifications, and other Contract Documents. The Contractor shall provide (at his own expense and without cost to the Owner) all equipment and assistance necessary for final inspection, including all tests specified or required by law.

e) The presence or absence of the Engineer or his representatives during the performance of the work shall not relieve the Contractor of any of his obligations to fulfill the Contract as prescribed.

GC-13 SUPERINTENDENCE

a) The Contractor shall keep on his work during its progress a competent superintendent and any necessary assistants, all satisfactory to the Engineer. The superintendent shall not be changed except with consent of the Engineer, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Any order given by the Engineer, not otherwise written request of the Contractor, be confirmed in writing. The Contractor shall give efficient supervision to the work, using his best skill and attention.

b) If the Contractor, in the course of the work, finds any discrepancy between the drawings and the physical conditions of the locality, or any errors or omissions in drawings or in the layout as given by points and instructions, it shall be his duty to immediately inform the Engineer, in writing, and the Engineer shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

GC-14 CONTRACTOR'S UNDERSTANDING

a) It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality, and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained.

b) Before commencing work on any branch or part of the work, the Contractor shall examine all areas, surfaces and spaces to which any work for this project will be attached or in which said work will be placed. The Contractor shall report necessary corrections immediately to the Engineer, and shall not proceed until correction (if any required) have been made. Commencing work on any surface or in any area or space implies the Contractor's acceptance of said surface, area and space as ready to receive his work, and also his acceptance of all job conditions. The Contractor shall verify all levels, dimensions and obtain all necessary measurements at the site of the work.

GC-15 SURVEYS, PERMITS, AND REGULATIONS

a) The Owner shall furnish all surveys unless otherwise specified.

b) The Contractor shall submit Drawings and Specifications to the local building department and where required, to State, Federal, County, and other authorities having jurisdiction over buildings, structures, and work of this character; he shall also procure and pay for all building permits and shall pay all fees, costs, and deposits required by other departments, authorities, agencies, and utilities for work in this Contract; he shall also pay for all inspections and certifications, all as part of this Contract and without extra cost to the Owner.

c) Unless otherwise specified, the Contractor shall also make all cash deposits required by City or other authorities and utility companies; he shall also make good, at his own expense and without extra cost to the Owner, all damage to streets, alleys, sidewalks, public and private property occasioned by operations under this Contract.

d) The Contractor shall and hereby does assume sole responsibility for and to pay all costs arising from provisions of any work, manufactured equipment or materials which are not furnished and installed in accordance with all laws, ordinances, rules, regulations (local, State, and Federal) governing same.

e) Unless otherwise specified, the Owner will procure and pay for easements for permanent structures, for permanent changes in existing buildings and structures.

f) The Laws, ordinances, and regulations (local, State, and Federal) of the place of construction shall govern all work in this Contract.

g) The Contractor shall include in his proposal the amounts of all sales, consumer use, or other taxes (at the place of construction) and shall pay costs of same as part of this Contract, without extra cost to the Owner.

h) Immediately upon receiving each permit, the Contractor shall deliver a positive copy to the Engineer. Upon completion of the Contract, the Contractor shall deliver the original permits to the owner.

i) One (1) complete set of Drawings bearing signed approval of the building department or other authority with jurisdiction over this work shall be returned to the engineer after the permit has been obtained.

j) The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Drawings and Specifications are at variance therewith, he shall promptly be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he shall bear all costs arising therefrom.

GC-16 PROTECTION OF WORK AND PROPERTY

a) The Contractor shall protect his work in approved, adequate manner from damage and shall maintain protection continuously during construction period.

b) The Contractors shall also protect the Owner's property from damage or loss occasioned by operations under this Contract. He shall make good in approved manner (at his own expense and without extra cost to the Owner), any such damage, injury, and loss, except such as is due to causes beyond his control and not through his fault or neglect. He shall also adequately and properly protect adjacent public and private property, as provided under the Contract Documents and by law.

c) The Contractor shall exercise all necessary precautions to prevent accidents and for the safety and protection of all persons (including his employees), on the work. He shall comply with the safety provisions of all applicable laws and building codes (Municipal, State, and Federal). Machinery, equipment, and all hazards of every description shall be guarded or eliminated in accordance with legally applicable safety provisions of the "Manual of Accident Prevention in Construction", latest edition, published by the Associated General Contractors of America.

d) The Contractor shall provide, erect, and maintain continuously and properly during the construction period, all required temporary railings, barricades, warning signs, lights, flares, and protection against hazards.

e) The Contractor is hereby empowered to act at his discretion (and without special directions or authority from the Engineer or the Owner), in an emergency endangering life or the safety of or damage to the work and adjoining property, to prevent such threatened injury, damage, or loss. The Contractor shall so act without appeal, if so directed or authorized. Compensations which is claimed by the Contractor on account of such emergency work shall be determined by agreement or by arbitration.

f) The Contractor shall provide constant protection against fire, rain, wind, storms, frost, and heat, so as to maintain work, materials, apparatus, and fixtures free from damage. At the end of each day's work or at any other work stoppage, cover properly all work liable to damage.

g) During cold weather the Contractor shall protect all work from damage. If low temperatures make it impossible to continue work safely in spite of cold weather precautions, cease work and notify the Engineer.

h) The Contractor shall remove snow and ice from roofs and elsewhere throughout the project, as conditions require, for safety and for proper access to and execution of all parts of the work, and at conclusion of the work, when necessary or directed.

i) The Contractor shall remove work damaged by the Contractor's failure to provide protection and replace same (as part of this Contract) in approved manner with new work and without extra cost to the Owner.

GC-17 CONSTRUCTION LAYOUT AND STAKING

All base lines and bench marks will be established by the Engineer, but the Contractor shall provide all stakes and similar materials, and shall give all manual assistance required by the Engineer in setting same; preserve all objects and marks defining lines and grades. The Contractor shall notify the Engineer ten (10) days in advance of the times when, and places at which, he intends to work, in order that base lines and bench marks may be furnished. All additional measurements that are required to complete work, in addition to base lines and bench marks, shall be made by the Contractor. No compensation shall be paid to the Contractor for the cost of any such work or for any delay occasioned by giving base lines and bench marks or making other necessary measurements, or for inspection; all such costs shall be included in the Contract prices for the appropriate item.

GC-18 ROYALTIES AND PATENTS

The Contractor shall pay all royalties and patents fees. The Contractor shall indemnity, save harmless and defend the Owner from any and all suits, actions, legal proceedings, claims, damages, demands, costs, expense, and attorney's fees, incident to any infringement of any patent or patents, appliances or materials used by the Contractor in the work or installed or incorporated in the work or in any way connected therewith. The Owner shall pay all license fees or royalties for processes.

GC-19 MATERIALS AND APPLIANCES

a) Unless otherwise specified, the Contractor shall provide and pay for all materials, accessories, equipment, expendable equipment, tools, transportation, water, all utilities, facilities, services, and labor necessary for the execution and completion of the work.

b) Unless otherwise specified, all materials shall be new, unused and of approved quality. When requested, the Contractor shall furnish to the Engineer affidavits or other satisfactory evidence that the materials furnished conform to the Specifications requirements.

c) Materials, equipment, and similar items are occasionally specified by name (in the Contract Documents) in order to establish minimum acceptable standards of quality requirements. Products of other reputable manufacturers (which are similar, comparable, and equal in all respects to those specified) will be considered, subject to the Engineer's approval.

d) Substitutions of materials, if permitted, shall be of equal or better quality than items indicated on the Drawings or specified, and are subject to the Engineer's approval. Substitutions made without his approval are at the Contractor's risk.

e) No materials, articles, equipment, or supplies produced in a penal or correctional institution shall be incorporated in this project under this Contract.

GC-20 SAMPLES

a) Wherever specified, throughout the Specifications or when requested by the Owner or the Engineer, the Contractor shall promptly submit samples of materials, colors, and finishes to the Engineer for approval. Execute the work in accordance with approved samples.

b) The Contractor shall mark samples (not containers for same) plainly, with the names of the Contractor, supplier of material, also trade name and location of building or structure for which they are proposed and their use. All carrying charges shall be prepaid.

c) Samples shall be submitted through the Contractor and not by subcontractors or suppliers. The Contractor shall promptly check all samples and verify that they conform to requirements of the Contract Documents. After checking and approval, the Engineer will return samples to the Contractor for distribution.

GC-21 CONTRACTOR'S EMPLOYEES

a) The Contractor shall fully inform himself of all laws, ordinances, rules, regulations, and decrees prevailing and relating to the employment of labor, also wage rates and payment of wages and which are applicable to this Contract at the place of building. The Contractor shall be governed thereby and shall comply fully therewith.

b) The Contractor shall employ only skilled mechanics experienced in the quality, character and type of work assigned to them. He shall enforce and maintain good order and strict discipline among his employees at all times.

c) Should the Owner or the Engineer deem any person employed on the work incompetent or unfit for his duties and shall so certify, the employee shall be immediately dismissed and shall not be re-employed on this project without the Engineer's written consent.

d) The Contractor is not required to employ for work under this contract any person to whom he may reasonably object.

e) The Contractor and each of his subcontractors shall pay each of his employees engaged in work on the project under this Contract in full (less deductions made mandatory by law) not less than once each week.

f) Claims and disputes regarding classifications of labor employed on this project may be decided by arbitration if agreeable to both parties and subject to the Owner's approval. Arbitrators shall be mutually acceptable. Arbitrators shall be selected in same manner specified in Article GC-11.

GC-22 CHANGES IN THE WORK

a) The Owner, without invalidating the Contract, may order extra work or make changes altering, adding to or deducting from the work, the Contract Sum being adjusted accordingly. All such work shall be executed under the conditions of the original Contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.

b) In giving instruction, the Engineer shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Engineer, and no claim for an addition to the Contract Sum shall be valid unless so ordered.

c) The value of any such extra work or change shall be determined in one or more of the following ways:

1. By estimate and acceptance in a lump sum.

2. By unit prices named in the Contractor subsequently agreed upon.

3. By cost and percentage or by cost and a fixed fee.

d) If none of the above methods is agreed upon, the Contractor, provided he receives an order as above, shall proceed with the work. In such case and also under case (3), he shall keep and present in such form as the engineer may direct, a correct account of the net cost of labor and materials, together with vouchers. In any case, the Engineer shall certify to the amount, including reasonable allowance for overhead and profit, due to the Contractor. Pending final determination of value payment on account of changes shall be made on the Engineer's estimate.

GC-23 CLAIMS FOR EXTRA COMPENSATION

If the Contractor claims extra Compensation on account of any instruction given by the Engineer by means of Drawings or otherwise, he shall so notify the Engineer in writing within ten (10) days after receiving said instructions and before proceeding with the work involved, except that in case of an emergency affecting or endangering life or property, in which case the procedure shall be the same as specified for changes in Articles GC-21 and GC-22.

GC-24 DEDUCTIONS FOR UNCORRECTED WORK

If the Engineer deems it inexpedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefore.

GC-25 DELAYS AND EXTENSION OF TIME

a) Should the Contractor be delayed at any time during the execution of the work by any act of the Owner, the Engineer, or by acts of the representatives or employees of either of such parties or by acts or operations of any separate contractor employed by the Owner or by changes in the work, or by strikes, lockouts, fire, unusual transportation delay, unavoidable casualties and any other causes beyond the Contractor's control, or duly authorized by the Engineer, or for any reason which the Engineer decides is justifiable, then the time of completion will be extended for such period as the Engineer deems reasonable.

b) No extension of time will be granted for delay occurring over seven (7) days before the Contractor makes written claim for same to the Engineer.

c) No extension of time will be granted Contractor when it is evident that he could have avoided need for time extension by the exercise of reasonable foresight.

d) The Contractor shall make proper allowance for inclement weather in his Proposal as same is not considered a valid reason for extension of time, unless abnormal for the season and place of the work.

e) If no schedule or agreement stating the dates upon which Drawings shall be furnished is made, then no claim for delay shall be allowed on account of failure to furnish Drawings until two (2) weeks after demand for such Drawings and not then unless such claim be reasonable.

f) Nothing contained in this article shall exclude the recovery of damages for delay by either party in accordance with other provisions of the Contract Documents.

g) In case of continuing cause of delay, only one (1) claim is necessary.

GC-26 COMMENCING WORK: COMPLETION DATE

a) The Contractor shall commence work under this contract within ten (10) days after, but not before, written notice to that effect has been given him by the Engineer. He shall complete said work within the number of consecutive calendar days or working days, as stipulated elsewhere in the Contract Documents. In case no written notice is given, but such work, however has been commenced, then the aforesaid completion period shall run from the date of commencement of the work.

b) The Contractor shall prosecute all work in this Contract in a diligent and orderly manner and shall conform to and cooperate with the Owner's and the Engineer's requests to expatiate particular portions of the work or to suspend operations on or transfer same to any portions of the work as deemed expedient by the Owner.

GC-27 CORRECTION OF WORK BEFORE FINAL PAYMENT

a) The Contractor shall promptly remove from the premises all materials condemned by the Engineer as failing to conform to the Contract, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the Contract and without expense to the Owner and shall bear the expenses of making good all work of other contractors destroyed or damaged by such removal or replacement.

b) If the Contractor does not remove such condemned work and materials within a reasonable time, fixed by written notice, the Owner may remove them and may store the materials at the expense of such removal within ten (10) day's time thereafter. The Owner may, upon ten (10) day's written notice, sell such materials at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

GC-28 SUSPENSION OF WORK

The Engineer shall have the authority to suspend the work wholly or in part, for such period of time as he may deem necessary, due to conditions unfavorable for the satisfactory prosecution of the work, or to conditions which, in his opinion, warrant such action; or, for such time as is necessary by reason of failure on the part of the Contractor to carry out orders given, or to perform any or all provisions of the Contract. No additional compensation will be paid the Contractor because of any costs caused by such suspension, except when the suspension is ordered for reasons not resulting from any act r omission on the part of the Contractor. If it becomes necessary to stop work for an indefinite period of time, the Contractor shall store all materials in such a manner that they will not become damaged in any way, take every precaution to prevent damage or deterioration of the work performed, provide suitable drainage, and erect temporary structures where necessary. The Contractor shall not suspend work without written authority from the Engineer.

GC-29 OWNER'S RIGHT TO DO WORK

In case the Contractor neglects to prosecute the work properly and fails to perform any provision or requirement of this Contract, the Owner may, without prejudice to any other redress he may have, make good such deficiencies and may deduct the cost thereof from any payment then due or to become due to the Contractor, provided, however, that such action and the amount charged to the Contractor are subject to the Engineer's approval.

GC-30 OWNER'S RIGHT TO TERMINATE CONTRACT

a) In case the Contractor or any of his subcontractors violate any of the provisions of this Contract, the Owner, upon the Engineer's certificate that sufficient cause exists to justify such action, may, without prejudice to any other right or redress, after serving seven (7) day's written notice upon the Contractor and his Surety, terminate the Contractor's employment. Unless the violation ceases within seven (7) days after such service of notice and satisfactory arrangements approved by the Engineer for correction be made, the Contract shall terminate at the expiration of specified seven (7) days.

b) In case the Contractor be adjudged bankrupt, or in case he should make a general assignment for the benefit of his creditors, or if a receiver be appointed on account of insolvency, or if he should repeatedly, persistently refuse or fail to supply enough properly skilled workmen or proper materials, or if he persistently disregard laws, ordinances and the Engineer's instructions above, terminate the Contractor's employment.

c) In case the Contract be terminated for reasons specified in Paragraphs a and b above, the Owner may, without prejudice to any other right or redress, take possession of the premises

and also of all materials, tools, equipment, appliances, and plant on the site, and use same as necessary and as conditions require, in completing the work by such methods as he considers expedient. In such case, the Contractor shall not be entitled to receive any additional payment until the work is completed. In case the unpaid balance of the Contract price exceeds the cost of completion of the work, including compensation services and damages, such excess will be paid to the Contractor. If such expense exceeds the unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner, as herein provided and the damage incurred through the Contractor's default, shall be certified by the Engineer.

GC-31 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

a) If the work in this Contract is stopped by court order, or other public authority for a period of thirty (30) days, through no act or fault of the Contractor or of anyone employed by him, then the Contractor may, upon seven (7) day's written notice to the Owner and the Engineer, terminate this Contract and recover from the Owner payment for all executed work, any proven loss sustained upon any plant or materials, and reasonable profit and damages.

b) In case the Engineer fails to issue any certificate for payment, through no fault of the Contractor, within fifteen (15) days after the Contractor's formal request for payment, or if the Owner fails to pay to the Contractor within fifteen (15) days of its maturity and presentation, any sum certified by the Engineer or awarded by arbitrators, then the Contractor, upon fifteen (15) day's written notice to the Owner and the Engineer, may stop the work or terminate this Contract, as specified in Paragraph "a".

GC-32 REMOVAL OF EQUIPMENT

In the case of annulment of this Contract before completion from any cause whatever, the Contractor, if notified to do so by the Owner, shall promptly remove any part or all of his equipment and supplies from the property of the Owner, failing which the Owner shall have the right to remove such equipment and supplies at the expense of the Contractor.

GC-33 OWNER'S USE OF COMPLETED PORTIONS

a) The Owner reserves the right to place in service, use, and occupy certain portions of the work prior to completion and acceptance of the entire project. The Contractor shall conduct his operations with a minimum of inconvenience to and interference with the Owner's occupancy. The Owner's occupancy of any portion or portions of the work does not imply acceptance of occupied portions or any other portion of the work, nor shall Owner's occupancy relieve the Contractor from his obligations to complete the work in its entirety and in accordance with the Drawings, Specifications, and other Contract Documents.

b) The Contractor shall make no claims upon the Owner for extra compensation on account of the Owner's occupancy of certain portions of the work, nor shall he be required to pay costs of operation of Owner's occupied portions or areas. The Owner will not cause the Contractor extra expense in preparing separate portions of the work for Owner's occupancy, prior to entire completion of said work.

GC-34 APPLICATIONS FOR PAYMENTS

a) Upon the first (1st) day of each month following the execution of the Contract and at least ten (10) days before each monthly payment is due, the Contractor shall submit to the Engineer an itemized application for payment, supported by receipts, vouchers, or other documents showing payments for materials, labor, to subcontractors, and such other evidence as is required by the Engineer. The Engineer will check and verify the Contractor's estimate of the amount of work done and of the value of the approved material and equipment items to be used in the completed project and delivered at the site or incorporated in the work in accordance with the Contract.

b) In order to avoid delay where the Owner is a Municipality or similar body, the Contractor should ascertain its regular meeting dates (for consideration of business) before making application for payments.

c) The first (1st) estimate shall be of the quantity and value of the work done, including the materials and equipment furnished by the Contractor since commencing work; succeeding estimates, EXCEPTING FINAL ONE, shall be of the quantity and value of the work done, including approved materials and equipment items furnished by the Contractor since the last previous estimate.

d) Where payments are made on value of work done as specified in Paragraphs "a" and "b", the Contractor, before first application shall submit to the Engineer a schedule (breakdown) of values of the various parts of the work, including quantities and so divided as to facilitate payments to subcontractors, and executed in such form as agreed upon between the Engineer and the Contractor. Upon approval by the Engineer, this schedule shall be used as a basis for certificates of payment. The Contractor shall submit a statement, based on the approved schedule, with each application for payment.

e) If and when payments are made on account of materials not incorporated in the work delivered and suitable stored on the site, or at other location approved by the Engineer, such payments shall be contingent upon submission by the Contractor of invoices, contracts, or such other evidence that the Contractor has purchased and agrees to pay for such materials, equipment and other items, including applicable insurance, which evidence shall protect Owner's eventual interest in such materials and equipment.

GC-35 CERTIFICATE FOR PAYMENTS

a) Upon application by Contractor for Payment, the Engineer shall, not later than the date when each payment is due, issue to the Contractor a certificate for payment for such amount as he decides is properly due, or else state in writing his reasons for withholding said certificate.

b) No certificate issued nor payments made to the Contractor, nor entire use or occupancy of the work or any part thereof by the owner implies acceptance of any work or materials not in accordance with the Contract. The making and acceptance of the final payment implies a waiver of all claims by the owner other than those arising from unsettled liens, from defective work appearing after final payment or from requirements of the Drawings or Specifications and of all claims by the Contractor, except those previously made and not yet settled.

c) In case the Owner fails to pay the sum stipulated in certificates for payment issued by the Engineer or in any arbitration award, upon demand when due, the contractor shall receive, in addition to the sum named in the certificate, interest on same at the legal rate in force at the place of construction.

GC-36 PAYMENTS

a) Not later than the fifteenth (15) day of each month, the Owner will make partial payment to the Contractor on the basis of a duly certified estimate of the work performed during the preceding month by the Contractor, but the Owner will retain ten percent (10%) of the amount of each such estimate until final completion and acceptance of all work covered by this Contract.

b) The Contractor shall pay:

1. for all transportation and utility services not later than the twentieth (20) day of the calendar month following that in which such services are rendered;

2. for all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the twentieth (20) day of the calendar month following that in which such materials, tools, and equipment are delivered at the site of the project, and the balance of the cost thereof not later than the thirtieth (30) day following the completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used; and,

3. to each of his subcontractors, not later than the fifth (5th) day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors, to the extent of each subcontractor's interest therein. "Work performed" as herein used implied the inclusion of materials for the project which are suitable stored at the site of the project, and useful in the construction of this project.

c) Where a contract is divided into several sections or divisions of work, and providing that one (1) or more sections or divisions of work are completed, and their completion is not dependent upon completion of the still uncompleted sections or divisions of work, and providing also that the operation and use has been accomplished by the Owner for the completed sections or divisions of work, payment of all or a portion of the 10% retainer due on the completed sections or divisions of work may be made, subject to approval by the Owner and the Engineer.

GC-37 FINAL PAYMENT ESTIMATE

a) The Engineer's final estimate shall be based upon a detailed estimate of the materials and equipment furnished and installed in the completed project according to the provisions of the Drawings and these Specifications. Final payment will be made to the Contractor for any amount remaining due upon the final inspection, testing and formal acceptance of the work by the Owner and the Engineer within thirty (30) days after the final completion and acceptance of the work.

b) Neither the final payment nor any part of ten percent (10%) of the retained amount shall become due until the Contractor, if required, delivers to the Owner a complete release of all liens arising from this Contract, or receipts in full in lieu thereof, and, if required in either case, an affidavit that so far as he has knowledge or information, the releases and receipts include all labor, materials, and equipment for which a lien could be filed; the Contractor may, in case any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be completed to pay in discharging said lien(s), including all costs and a reasonable attorney's fee.

GC-38 PAYMENTS WITHHELD

The Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary to protect the Owner from loss on account of:

a) Defective work not remedied.

b) Claims filed or reasonable evidence indicating probable filing claims.

c) Failure of the Contractor to make payments properly to Subcontractors or for material or labor.

d) A reasonable doubt that the Contract can be completed for the balance then unpaid.

e) Damage to another Contractor.

When the above grounds are removed, payment shall be made for accounts withheld because of them.

GC-39 ASSIGNMENT

Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Engineer.

GC-40 OTHER CONTRACTS

a) The Owner reserves the right to award and may award other contracts for work in connection with this project. The Contractor shall afford other contractors access to the site to such portions of the work on which they may be engaged, and reasonable opportunity for deliver and storage of their materials and execution of their work. He shall also cooperate fully with such Contractors, shall properly connect and coordinate his work with theirs. The Contractor shall not interfere with the performance of work by other (separate) Contractors.

b) If the Contractor's work or any part thereof depends on any of the other contractor's work for proper execution, the Contractor shall inspect and immediately report to the Engineer any defects in the work which interfere with proper execution of his work. The Contractor's failure to make such inspection and report to the Engineer any defects in the work which interfere with proper execution of his work. The Contractor's failure to make such inspection and report implies his acceptance of the other Contractor's work as being in readiness to receive his work.

c) In order to insure proper execution of the subsequent work in his contract, the Contractor shall measure the work already in place and shall immediately report to the Engineer any discrepancy between the executed work and the Drawings and Specifications.

d) In case the Contractor causes damage to the work of any separate contractor (who is employed by the Owner), the Contractor shall and hereby does agree, upon receipt of due notice, to settle with separate contractor by agreement or arbitration, provided he will so settle. If the separate contractor sues the Owner on account of any alleged damage to have been so caused, the Owner will notify the Contractor, who shall defend the suit at the Owner's expenses, and if any judgement is rendered therefrom, the Contractor shall pay or satisfy same and pay all costs incurred by the Owner.

GC-41 SUBCONTRACTS

a) In order to expedite the work, the Contractor shall, as soon as possible, submit in writing for the Engineer's approval, a complete list of names of his proposed subcontractors for the project; he shall not employ any subcontractor to whom the Owner or the Engineer objects. The Contractor shall not be required to employ any subcontractor to whom he reasonably objects.

b) The Contractor shall and hereby does agree that he is as completely responsible to the Owner for the acts and omissions of his subcontractors and of all persons employed directly or indirectly by them, as he is for all persons employed by himself.

c) The Contractor shall and hereby does agree that each subcontract shall include the following clause: "The Subcontractor shall and hereby does agree to be bound to the Contractor by all the requirements of the General Conditions, the Special Conditions, all sections of the Specifications and the Drawings (all of which are part of the Contract between the Owner and the Contractor, to be dated at the time of signing the Contract as to this work and other work), and to assume toward the Contractor all obligations and responsibilities as to the Subcontractor's work that Contractor by such documents, has assumed toward the Owner. The subcontractor shall and hereby does agree that the Contractor shall at all times have the right, subject to the Owner's written consent, to assign his subcontract to the Owner, and in the event of such assignment, the Owner shall have the right to terminate the subcontract in case of delays caused by strikes, and upon the same terms and conditions as are contained in the Contract between the Owner and the Contractor."

d) Nothing contained in this Article or the Contract Documents shall create any contractual relations between any subcontractor and the Owner.

e) Wherever practicable, when requested, the Engineer will furnish evidence to any subcontractor of amount certified on his account.

f) Should either party to this Contract suffer damages because of any wrongful acto or neglect of the other party or of anyone employed by him, claim shall be made in writing within ten (10) days of the first observance of the damage and not later than the final payment, except as expressly stipulated otherwise in the case of defective materials and workmanship, and shall be adjusted by agreement or arbitration.

GC-42 CONTRACT SECURITY BOND

The Contractor shall furnish a surety bond (form attached) in an amount of at least equal to 100 percent of the Contract price as security for the faithful performance of this Contract and for the payment of all persons performing labor and furnishing materials in connection with this Contract.

GC-43 INDEMNIFICATION AND INSURANCE

a) The Contractor shall indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work provided that any such claim, damage, loss or expense, that is:

1. Attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom; and,

2. Caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by them or by anyone whose acts by any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

b) In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by them or anyone for whose acts by any of them may be liable, the indemnification obligation under this Article GC-43 shall not be limited in any way by any limitations on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under Workman's Compensation acts, disability benefit acts, or other employee benefit acts.

c) The obligations of this Article GC-43 shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, Drawings, opinions, reports, surveys, change orders, designs or specifications, or direct instructions to the Contractor, provided such acts are the primary cause of the injury or damage.

d) Without limiting its liability under this Contract, the Contractor shall procure and maintain at his expense during the life of this contract, insurance of the types and in the minimum amounts stated in the Special Conditions of Division 1.

e) The Comprehensive General Liability policy shall provide coverage for blasting and explosion, injury to or destruction wires, conduits, pipes, mains and sewers, and other property under the surface of the ground; and the collapse of or injury to any building or structure.

f) The Comprehensive Liability policy shall include blanket contractual liability coverage or a contractual liability endorsement covering the liability assumed by the Contractor under this agreement with limits not less than those specified in Subparagraph 2 hereof. The certificate of insurance to be furnished hereunder shall reflect such coverage.

g) The Owner's Protective policy shall name the Owner and the Engineer as insured and duplicate copy of the policy shall be furnished to each of them.

h) The Contractor shall also take out and maintain at his expense during the life of this Contract Builder's Risk Insurance satisfactory to the Owner which shall protect the Contractor and the Owner, as their interest may appear, for the following hazards to the work, materials, and equipment suitable stored at the site, and Contractor's construction equipment, materials and temporary structures: fire and lightning, extended coverage, including windstorm, hail, explosion, riot, riot attending strike, civil commotion, aircraft, vehicle and smoke damage, and vandalism and malicious mischief. Such policy shall be in the Agreement or such other amount as shall be satisfactory to the Owner and a duplicate copy thereof shall be submitted to the Owner through the Engineer.

i) Said insurance shall be written by a company or companies satisfactory to the Owner. Before commencing any work hereunder, certificates evidencing the maintenance of said insurance shall be furnished to the Owner, the Engineer, and shall contain the following statement: The insurance evidence by this certificate will not be canceled or altered except after ten (10) days from receipt by the Owner and the Engineer of written notice thereof.

j) Any subcontractor of the Contractor shall be required to procure and maintain during the life of the subcontract the insurance required of Contractor hereunder and comply with the provisions of this Article.

k) In the event any part of the work to be performed hereunder shall require the Contractor or his subcontractor to enter, cross or work upon or beneath the right-of-way or other property of a railroad, the Contractor, in addition to the indemnification and insurance requirements of this Article, shall comply with the related requirements for such work as are set out in the Special Conditions hereof.

GC-44 CASH ALLOWANCE

a) Wherever cash allowances are specified in the Contract Documents, the Contractor shall include all of them in his proposal and in the Contract amount, and shall cause the work covered by them to be done by such subcontractors and for such sums as directed by the Engineer.

b) The Contractor shall and hereby does declare that the Contract amount includes such sums for expenses and profit on account of all cash allowances as he considers proper. No claims for taxes, expenses and profit, other than those included in the Contract amount, shall be allowed or paid.

GC-45 CUTTING, FITTING, PATCHING, AND DIGGING

a) The Contractor shall do all cutting, fitting, digging, and patching of his work which is required to make its several parts come together properly and so that it may receive or be received by the work of other (separate) contractors as shown on and reasonably implied by the Drawings and Specifications for the completed work; he shall also make good after them as directed by the Engineer.

b) The Contractor shall do no cutting, digging, or otherwise altering of the work which endangers the structure and shall cut no structural members of the work of any other separate contractor except by the Engineer's signed permission.

c) Any and all costs occasioned by badly timed and defective work shall be paid by the party responsible therefore.

d) The Engineer's permission to patch any area of item of work does not imply a waiver of his right to require removal and replacement of such work (without extra cost to the Owner) if, in his opinion, such patching does not satisfactorily restore the quality and appearance of the work.

GC-46 USE OF PREMISES

a) The Contractor shall make satisfactory arrangements for delivery and storage of his materials and equipment after delivery and also before and during the construction period. He shall confine his equipment, apparatus, storage of materials and operations of his employees within the limits prescribed by law, ordinances, permits, and directions of the Engineer and the Owner, and shall not needlessly encumber the premises and adjacent streets with his materials. Should it

become necessary to move the materials stored on the premises, the Contractor shall move same to new locations, as conditions require, and without extra cost to the Owner.

b) The Contractor shall not load or permit any part of the structure(s) to be located with a weight endangering its safety.

GC-47 WORKING HOURS

a) The work shall be done under the observation (on the Owner's behalf) of the Engineer or inspectors appointed by the Owner, and unless special arrangements are made with the Owner, work shall be done only during regular and commonly accepted working hours. No work shall be done nights or Sundays unless special signed order is issued by the Owner or the Engineer.

b) Should the Contractor desire to proceed with the work under overtime conditions, he shall propose a work schedule to the Engineer in writing for approval. No overtime work shall proceed without written approval from the Engineer.

c) Should overtime schedules be approved, the Contractor shall reimburse the Owner at cost for the Cost of Inspection during these periods.

d) Conduct night or Sunday work in residential areas with a minimum amount of noise and disturbance.

GC-48 GUARANTY-WARRANTY

a) The suppliers and erectors of all equipment, apparatus, and work furnished and used in the construction of this project shall and hereby do warrant, and the Contractor shall and hereby does guarantee that all such equipment, apparatus and work will remain free of defective materials and workmanship for a period of one (1) year from date of final acceptance by the Owner and the Engineer, except where longer periods are herein specified, in which case they shall govern.

b) After final payment: The Contractor shall promptly correct any defects due to defective materials or workmanship and pay for any and all damage to other work resulting therefrom which shall appear within a period of one (1) year from the date of final payment, and in accordance with the terms of special guarantees provided in the Contract. Where longer guarantee periods are specified, the longer periods shall apply.

c) All above-mentioned parties further agree that they will, at their expense and without extra cost to the Owner, remove, repair or replace all such defective materials, equipment, apparatus, and work, and all other work damaged thereby which becomes defective during the term of the Guaranty-Warranty.

d) Neither the foregoing paragraphs nor any provisions in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability for defects for less than the legal limit of liability in accordance with the law of the place of construction. The Owner shall give reasonable notice promptly of observed defects. All questions arising under this Article GC-48 shall be decided by the Engineer, not withstanding final payment.

e) Nothing in Article GC-48 implies that Guaranty and Guaranty-Warranty applies to or covers work which had been abused or neglected by the Owner or his successor-in-interest.

GC-49 CLEANING UP

a) The Contractor shall at all times keep premises free from accumulations of waste material or rubbish caused by his employees or work.

b) Upon completion of the work, the Contractor shall remove all his rubbish from and about the structure(s), building(s), and premises, also all his tools, equipment, scaffolding, and surplus materials and shall leave his work clean, ready for use. In case of dispute, the Owner may remove the rubbish and surplus materials and charge cost of removal to the Contractor (or separate contractors, if any) in proportion to amounts determined by the Engineer to be just.

END OF SECTION

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - The scope of work shall consist of providing all labor, materials, equipment, and services required in the excavation, trenching, and backfilling for utilities systems.

1.3 CONNECTION TO EXISTING UTILITIES - Contractor shall coordinate with representatives of all utilities to be connected into. Contractor shall coordinate with the Owner for all interruption of utilities and shall submit to the Owner a schedule of all interruptions.

1.4 SUBMITTALS - Contractor shall submit to the Engineer in a timely manner all test results specified herein. Failure to submit in a timely manner may be cause for suspension of work.

1.5 TESTING - All testing shall be done by an approved Testing Laboratory. This testing laboratory shall be approved by the Engineer prior to construction.

PART 2 - MATERIALS

2.1 SOIL MATERIALS - In general, shall be free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, frozen, deleterious, or objectionable matter.

2.1.1 BACKFILL - Shall conform to the general requirements for soil materials above and shall be classified as GM, SM, SC, by ASTM D 2487 with a maximum particle size of 3 inches.

2.1.2 SUBGRADE MATERIALS FOR ROADS AND PAVED AREAS - Shall conform to the general requirements for soil materials above and shall be classified as GW, GP, GM, SW, SP, SM by ASTM D 2487 and meet the following: liquid limit shall not exceed 35 percent (35%) when tested in accordance with ASTM D 423, plasticity index shall not exceed 12 percent (12%) when tested in accordance with ASTM D 424, and not more than 25 percent (25%) by weight shall be finer than the number 200 sieve.

2.1.3 SAND - Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as SW or SP by ASTM D 2487 of which no more than 10 percent (10%) by weight shall be finer than the number 200 sieve.

2.1.3.1 CONCRETE SAND - Shall conform to the general requirements for sand above and gradation shall conform to fine aggregate requirements in accordance with ASTM C 33.

2.1.4 GRAVEL - Shall conform to the general requirements for soil materials above and shall be clean, coarse grained material classified as GW, GP by ASTM D 2487 of which no more than 10 percent (10%) by weight shall be finer than the number 200 sieve.

2.1.4.1 CRUSHED STONE - Shall conform to the general requirements for gravel above and a minimum of 10 percent (10%) of the particles shall have at least one fractured face and size in accordance with ASTM C 33.

2.1.5 BEDDING - Shall be concrete sand, gravel or crushed stone or as indicated on the drawings.

2.1.6 BORROW - Shall be materials conforming to the requirements for sand, gravel, bedding or backfill. Other borrow materials from approved sources off Owner's property.

PART 3 - EXECUTION

3.1 GENERAL - Limits of excavation shall be as required for construction and/or as indicated on the drawings.

3.2 SURFACE PREPARATION

3.2.1 CUTTING PAVEMENT, CURBS, AND GUTTERS - Make cuts with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one (1) foot beyond each edge of pits.

3.3 GENERAL EXCAVATION - Shall be to the elevations and dimensions indicated or otherwise specified. Keep excavations free from water while construction is in progress. Notify the Engineer immediately in writing if it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated. Make trench sides as nearly vertical as practical except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe, conduit or duct. Excavate ledge rock, boulders, or hard materials to an over depth at least 4 inches below the bottom of the pipe, conduit, or duct and appurtenances unless otherwise indicated or specified. Blasting will not be permitted. Stabilize soft, weak, or wet excavations as indicated. Use bedding material to refill over depths to the proper grade and place 6-inch maximum layers. At the option of the Contractor, the excavations may be cut to an over depth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe, conduit, duct or structure on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded and dimension as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. All excavation shall be unclassified material, unless otherwise indicated.

3.3.1 ROCK EXCAVATION - When so indicated and provided for classified excavation the following definitions shall apply.

3.3.1.1 GENERAL - For purposes of identifying and measuring rock which may be encountered during excavation, the following definitions shall be used. The definitions are based on minimum equipment requirements which must be equalled or exceeded by the Contractor. If Contractor chooses to use equipment of lessor size, capacity or power than specified for excavating purposes, Contractor will assume all responsibility for the cost and method of removal of material resembling rock which cannot be removed with his equipment. Therefore, the Contract Unit Prices submitted by the Contractor for rock excavation will only be applicable if the Contractor's equipment equals or exceeds the equipment requirements specified below.

3.3.1.2 GENERAL EXCAVATION - Rock is defined as any sound and solid mass, layer, or ledge of mineral matter in place and of such hardness and texture that it cannot be effectively loosened or broken down in a single pass with the following equipment:

3.3.1.2.1 A late model crawler-type tractor rated with at least 200 net flywheel horsepower, equipped with a hydraulic ripper with one digging point of standard design and adequate size, and with tractor operating in low gear, or:

3.3.1.2.2 A three cubic yard (3 cu. yd.) capacity front-end loader, or:

3.3.1.2.3 A 3/4 cubic yard capacity hydraulic backhoe or shovel.

3.3.1.3 PIT AND/OR TRENCH EXCAVATION - Rock is defined as any natural, undisturbed subsurface material encountered during pit and/or trench excavation operations which cannot be excavated and removed by a 3/4 cubic yard capacity hydraulic backhoe.

3.3.2 INTERFERENCES - Where excavation and trenching operations intersect trees or tree root systems, the trees and the main portion of its root system shall be removed unless otherwise directed by the Engineer. The excavation left by the removal of the trees shall be backfilled, compacted and graded as specified.

3.3.3 REMOVAL OF UTILITY LINES - When utility lines that are to be removed are encountered within the area of operations, the Owner shall be notified in ample time for the necessary measures to be taken to prevent interruption of the service.

3.4 GENERAL BACKFILLING - Surround pipes, conduits, or ducts with backfill as indicated. Ensure that backfill is placed completely under pipe haunches. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 12-inch maximum loose lifts unless otherwise specified. Compact loose lift as specified in Paragraph "Compaction" before placing the next lift. Do not backfill in freezing weather, where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade of two feet for water mains, gas mains, storm drains, and for water mains. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities.

3.5 COMPACTION - The Contractor shall have compaction tests made, at his own expense, on trench backfill at the rate of one test per six (6")inch lift per 500 lineal feet of trench for the initial two (2) feet of backfill over the pipe. The remainder shall be tested at the rate of one test per two (2) foot depth of backfill per 500 lineal feet of trench.

3.5.1 TESTING LABORATORY - Testing Laboratory shall be approved by the Engineer prior to construction. The test results shall be submitted directly to the Engineer in a timely manner. Failure to do so may result in the suspension of work.

3.5.2 DEGREE OF COMPACTION - Backfill shall be tamped in six (6) inch lifts and thoroughly compacted by a mechanical tamper to ninety percent (90%) of the Modified Proctor Test or that of the surrounding ground surface, except under pavements. Compaction shall be ninety-five percent (95%) of the Modified Proctor Test under pavements.

3.6 PROTECTION OF EXCAVATION

3.6.1 SHORING AND SHEETING - Provide shoring, bracing, cribbing, underpinning and sheeting if required.

3.6.1.1 Prevent undermining of pavements and slabs.

3.6.1.2 Banks may be sloped where space permits and as directed.

3.6.1.3 Where shoring and sheeting materials must be left in place in the completed work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 3 feet below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

3.6.2 DE-WATERING - Include in de-watering the collection and disposal of all forms of surface and subsurface water that are encountered in the course of construction. Water shall be removed by pumping or other methods to prevent the softening of surfaces exposed by excavation. Relieve the hydrostatic head in previous zones below the subgrade elevation in layered soils in order to prevent uplift. Operate the de-watering system continuously, 24 hours per day, 7 days per week until such time as construction work below existing water level is complete, unless directed otherwise.

3.7 FINISH OPERATIONS

3.7.1 GRADING - Shall be to finished grades indicated within one-tenth (1/10) of a foot. Existing grades which are to remain but are disturbed by the Contractor's operations shall be graded as directed.

3.7.2 BORROW AREAS - Shall be graded to drain properly. Maintain and restore borrow pits.

3.7.3 DISPOSITION OF SURPLUS MATERIALS - Surplus or other soil material not required or suitable for filling, backfilling or grading shall be removed from Owner's property.

3.7.4 PROTECTION OF SURFACES - Protect newly graded areas from traffic, erosion, and settlement that may occur. Repair or re-establish damaged grades, elevations or slopes.

3.7.5 PAVEMENT REPAIR - Repair pavement, curbs, and gutters as indicated. Do not repair pavement until trench or pit has been backfilled and compacted as herein specified. Provide a temporary road surface of gravel, crushed stone or other approved material over the backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. A minimum one way traffic shall be maintained at all times on roads and streets crossed by trenches; roads and streets shall be fully opened to traffic as quickly as possible.

END OF SECTION

DIVISION 2 - SITEWORK & DEMOLITION
SECTION 2B - SEEDING & MULCHING

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of providing all material, labor, equipment, and services required for fertilizing, seeding and mulching as specified herein and shown on the drawings.

1.3 DATES FOR SEEDING - Seedbed preparation and seeding shall be done between the dates of 15 March and 15 May for spring planting, and 15 August and 10 October for fall planting, except as otherwise directed in writing from the Engineer.

PART 2 - PRODUCTS

2.1 SEED - Shall be in accordance with the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. Seed shall be furnished in labeled, standard containers. Seed which has become wet, moldy, or otherwise damaged will not be acceptable. The pure live grass seed mixture to be used shall be as follows:

2.1.1 LAWN SEEDING - Fescue (Kentucky 31)
(Festuca e. arundinecea - K-31)
Total Pounds Pure Live Seed Per Acre -- 350

2.1.2 PURE LIVE SEED - The following formula shall be used to determine the amount of commercial seed required to provide in each kind of seed the specified quantities of pure live seed, with Purity and Germination expressed as whole numbers:

$$\frac{\text{Pure Live Seed} \times 100 \times 100}{\text{Purity} \times \text{Germination}} = \text{Pounds Commercial Seed Required}$$

2.2 FERTILIZER - Shall be a commercial product of 16-16-8 grade. Fertilizer shall be free-flowing and suitable for application with mechanical equipment, delivered in sealed containers, each fully labeled, conforming to the laws of the state in which the fertilizer is to be used, and bearing the name, trade name or trademark and warranty of the producer.

2.3 SOIL FOR REPAIR - Of damaged areas shall be topsoil, essentially free of subsoil, organic debris, objects larger than 1 inch in any diameter, substances harmful to plant growth, and any other material constituting a hindrance to grading, seeding and maintenance operations.

2.4 WATER - Shall be free from detrimental amounts of oil, acid, alkali, salt, or other substances harmful to growth of grass and shall be from an approved source.

PART 3 - EXECUTION

3.1 PREPARATION OF SEEDBED

3.1.1 GENERAL - All vegetation on the seedbed areas and all debris unearthed during preparation of the seedbed, including stones larger than 1 inch in diameter for lawn seeding and 1 inch for field seeding shall be removed from the site. Ground surfaces shall conform to the grades indicated and any deviations therefrom shall be corrected prior to seeding. Soil used for repair of erosion and correction of grade deficiencies, shall conform to that specified in the products paragraph.

3.1.2 TILLAGE - After the areas have been cleared and brought to grade, the ground shall be thoroughly tilled to a depth of four (4) inches. Soil texture after tillage shall be uniformly granular, free of wet, compressed or dry lumps to the full depth specified. Tillage shall be accomplished only when soil conditions permits proper manipulations. Undulations and irregularities in the ground surface resulting from soil preparation operations shall be corrected with depressions filled and all surfaces smoothed to conform to the established grades.

3.1.3 APPLICATION OF FERTILIZER - Fertilizer shall be applied at the rate of 450 pounds per acre. Fertilizer shall be distributed uniformly over the prepared seedbed and incorporated into the soil to a depth of not over 1 inch.

3.2 PLANTING SEED - GENERAL - Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate of 350 pounds of pure live seed per acre for lawn seeding.

3.3 HYDRAULIC SEEDING AND MULCHING - Fertilizing and mulching by hydraulic spray application. Seed and fertilizer in the amounts per acre designated, and wood cellulose fiber mulch at the rate recommended by the manufacturer for the specific fiber mulch used, shall be combined with water to provide a slurry, and hydraulic application shall be performed in such manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded at rates not less than indicated herein. No following compaction shall be done.

3.4 PROTECTION AND CLEANUP - After seeding and mulching operations have been completed, barricades and approved warning signs shall be erected as required to provide protection against traffic and trespass. Excess material from seeding and mulching operations, and all debris, shall be cleaned up and disposed of off the site.

3.5 ESTABLISHMENT

3.5.1 GENERAL - The Contractor shall care for the seeded areas for a period of 30 days after completion of all seeding or until all work on the entire project has been completed and accepted, which ever period is the longer. Fall seeding, when authorized in writing to be performed after the planting period specified has passed, shall be maintained until June 1st of the following season. Work shall include watering, mowing, weed eradication, protection of embankments and ditches from erosion and maintenance.

3.5.2 WATERING - The newly planted areas shall be watered frequently to promote seed germination. The ground surface shall be kept moist by sprinkling until a show of green is obtained. Light sprinkling shall be preformed in a manner that will not cause seed displacement and surface erosion. As turf develops, the frequency of waterings shall be reduced and application

volumes increased, as growth and moisture requirements dictate. Watering equipment shall be of a type that will not damage the finished surface.

3.5.3 MOWING - The seeded areas shall be mowed with approved mowing equipment to a height of two inches whenever the average height of grass becomes four inches for lawn turf and to a height of four inches whenever the average height of grass becomes ten inches for field seeding. When the amount of cut mowed grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be uprooted and removed from the area, or treated with a selective herbicide.

3.5.4 PROTECTION - All seeded areas shall be maintained free from erosion.

3.5.5 RE-SEEDING AND REPAIR - During the maintenance period, any eroded or otherwise damaged areas shall be promptly repaired to reestablish the end condition specified herein. Repair shall include all of the operations involved to produce the end result specified prior to damage that are indicated for the particular area.

END OF SECTION

DIVISION 2 - SITEWORK & DEMOLITION
SECTION 2PP - WELL PROTECTION

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 DESCRIPTION - In the construction of the well, all necessary precautions must be taken by the Contractor to maintain the premises in sanitary condition and to prevent contaminants from entering the well, either through the constructed opening or by seepage through the ground surface. Water and materials used in construction operations shall be reasonably free of contamination and, if their nature permits, shall be adequately disinfected with chlorine before use.

PART 2 - PRODUCTS

2.1 DISINFECTANT - The disinfectant shall be a chlorine solution sufficient to produce a minimum of 50 ppm (parts per million) available chlorine when mixed with the total volume of water in the well.

PART 3 - EXECUTION

3.1 DISINFECTION OF WELL - Immediately preceding disinfection, all oil, grease, soil, and other materials which could harbor and protect bacterial from disinfectants shall be removed from the well. Unless prior approval is obtained for employing chemicals or unusual cleaning methods, the cleaning operation shall be carried out by pumping and swabbing only. Contractor shall disinfect the well upon installation of test pumping equipment. Test pumping equipment shall be thoroughly hosed, scrubbed, or otherwise cleaned of foreign material.

3.1.1 Contractor shall provide reliable means for insuring that the disinfectant is uniformly applied throughout the entire water depth of the well without relying on subsequent mechanical or surging action for dispersing the disinfectant. All accessible portions of the well above the water level shall be maintained in a damp condition with water containing the required concentration of disinfectant for not less than 20-minutes. The disinfectant shall be left in the well for 24 hours. After the contact period, the well shall be pumped until the odor of chlorine is removed. The disposal point for the purged water shall be selected so as to minimize potential damage to aquatic life or vegetation.

3.2 PROTECTION OF WELL - At all times, the Contractor shall protect the well from tampering or entrance of foreign matter. After all work is completed, the Contractor shall clean up the well and abandoned well sites and remove all equipment and material to the satisfaction of the Engineer.

3.2.1 COMPLETION - Upon completion of capacity test pumping and disinfection of the new well, the Contractor shall provide temporary means to cap the well, approved by the Engineer. The ground immediately surrounding the well casing shall be sloped away from the well.

END OF SECTION

DIVISION 2 - SITEWORK & DEMOLITION
SECTION 2X - WELL DRILLING

PART 1 - GENERAL

1.1 NOTICE - Provision of General Requirements, Division 1, are a part of this Division and Section.

1.2 DESCRIPTION

1.2.1 The work under this section consists of the development of a drilled water well approximately 800 to 1,000 feet or otherwise determined by the Engineer, Contractor shall coordinate with the State Geologist and Engineer as required in these specifications. Contractor shall furnish all labor, tools, and equipment necessary to perform work and test described herein.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 The diameters and estimated depths of the drill holes are shown on the plans. Contractor shall drill the twelve inch (12") diameter hole to the full depth before reaming the hole to receive casing and grout ring, unless otherwise authorized by the Engineer.

3.1.1 Should it be found necessary to change the size of the well, or if any change in classification is to be made, the drilling shall not proceed until all necessary measurements have been made and both Contractor and Engineer have agreed to the well depth. All measurements shall be made in the presence of the Engineer. Contractor shall not drill beyond the estimated depths by more than 50 feet without a written order from the Engineer.

3.1.2 The Owner reserves the right to cease drilling operations when, in its opinion, a sufficient depth of well has been drilled to furnish an adequate supply of water. If an adequate supply of water is not reached within a reasonable depth, the Owner reserves the right to change location for re-drilling or to cease operations. The Engineer will determine what is considered a reasonable depth. The drilling may be abandoned at any depth by the Owner if, in the opinion of the Engineer, it is not feasible to continue. (Payment will be made at the applicable unit bid price per foot of well actually drilled and/or materials supplied and placed and services rendered by Contractor at unit bid prices for the respective items.)

3.1.3. If Contractor ceases drilling operations on his own initiative, because of drill rig failure, loss of tools, or any other reason, before the well is drilled to the specified depth, the drill hole will be rejected by the Engineer and abandoned as specified herein. No payment will be made for work or materials supplied in connection with an such abandoned well.

Casing shall have guides welded in place in such a manner as to permit unobstructed flow and uniform thickness of grout. The guides shall be located at the top and bottom and at 100 foot spacing along the entire length of the casing.

Drilling cuttings and other geological data as required shall be submitted to Missouri Department of Natural Resources, Division of Geology and Land Survey. Final depth of the well, and final depth of the permanent casing shall be determined by Missouri Department of Natural Resources, Division of Geology and Land Survey after examination of drilling cuttings. Personnel from the Missouri Department of Natural Resources, Division of Geology and Land Survey must be present during grouting and shall be notified 48 hours before grouting.

When the well is not being worked on, it shall be capped in such a manner as to prevent contamination.

3.2 PLUMBNESS AND ALIGNMENT - The completed drill hole shall be sufficiently plumb and straight so that there will be no interference with the installation of the casing or with the installation, alignment, and operation of a submersible power pump.

3.2.1 After construction of the well and before test pump equipment is installed, the plumbness and alignment of the hole shall be checked by lowering to a depth of 250 feet and turning in the hold a 40 foot length of straight standard steel welded join casing pipe. The outside diameter of the pipe section shall be no more than 0.5 inch smaller than the inside of that part of the hole being tested. This test shall be performed in the presence of the Engineer, who will watch for any binding of the pipe in the hole and determine any remedial action, if necessary.

3.3 MUDDING AGENT - No sand, dirt, rocks, mud, oil drillings or bailings, or any other foreign materials from the land surface shall be allowed to fall into any hole being made. If necessary to use drilling sludge, Contractor may use commercial bentonite or other appropriate commercial mudding agent, but only in that part of the hole to be cased.

3.4 PRELIMINARY TEST PUMPING - The well must be capable of delivering at least 140 gpm. Preliminary yield tests are needed as drilling of the well progresses to determine whether the well should be drilled deeper, whether development should be undertaken, or whether a satisfactory water capacity has been obtained. Where water-bearing formations are encountered, the Contractor shall perform these tests in the presence of the Engineer. These tests may be performed by bailing, surging, or other means as may be necessary, and the results shall be recorded. No water-bearing strata for the well shall be developed by perforating casing unless approved by the Engineer.

The pump used for yield and draw down test shall have a capacity of 330 gpm and the test will be performed for 24 hours or until stabilized draw down has continued to 6 hours.

The following data shall be provided: A) Test pump capacity Head; B) Static water level; C) Depth of test pump setting; D) Starting and stopping time of each cycle; E) Recording and graphic evaluation at 1 hour intervals of pumping rate, pumping water levels, draw down, and water recovery rate and levels.

Water shall be testing by an approved laboratory after test pumping.

If the well must be abandoned, it shall be sealed in such a manner as to prevent exchange of water between aquifers, with a neat cement grout, all fill material other than grout shall be disinfected and free of foreign material. The grout will be applied through a pipe, tremic, or batter of the well seal completion.

A permanent draw down gauge shall be installed.

After installation of permanent pumping equipment, the system shall be disinfected in accordance with AWWA A-100.

Samples shall be collected and submitted for microbiological testing after disinfecting and purging of the well and before placing the well in service.

END OF SECTION

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - See Drawings and details for type, locations, and sizes of concrete and cement work. All items in the nature of concrete, unless specifically excluded, materials and delivery, shall be furnished by the Contractor.

PART 2 - MATERIALS

2.1 PORTLAND CEMENT - Shall conform to the "Standard Specifications for Portland Cement" - ASTM Designation C-150, Type 1 or Type 3.

2.2 FINE AGGREGATE - Shall comply with ASTM C-33 and be graded as follows:

Sieve Size	Total Passing (% by Weight)
⅜" square	100
No. 4	95 - 100
No. 16	45 - 100
No. 50	10 - 30
No. 100	2 - 10

2.3 COARSE AGGREGATE - Shall be gravel or limestone and comply with ASTM C-33, Size #67. The gradation of ¾" aggregate required for all concrete shall be as follows:

Sieve Size	Total Passing (% by Weight)
1" square	100
¾"	90 - 100
⅜"	20 - 55
No. 4	0 - 10
No. 8	0 - 5

2.4 Lignite particles shall not be over ¼ of 1% and flint or high volume cherty materials in excess of 1% will not be acceptable.

2.5 WATER - Shall be free of any detrimental impurities.

2.6 AIR ENTRAINING AGENT - Prote Master Builders MB-VR, Sika AEA or Grace DAREX AEA conforming to ASTM C260 Spec for Air Entraining Admixtures for concrete, controlled at 6-½%, ±1% for ¾" aggregate concrete.

2.7 WELDED WIRE FABRIC - Reinforcing wire fabric shall conform to ASTM A185 Spec for Welded Steel Wire Fabric for Concrete Reinforcement, using bright basic wire meeting ASTM A82 Spec, spot-welded at intersections and unless otherwise noted 6 x 6 W1., 4 x W1.4.

2.8 TIE WIRE - For bars and fabric shall conform with ASTM A82 Spec for Cold-Drawn Steel Wire for Concrete Reinforcement.

PART 3 - EXECUTION

3.1 CONTROL AND MIX

3.1.1 PROPORTIONS - Concrete shall be proportioned by the water-cement ratio method. The proportioning of materials shall be based upon requirements for a plastic and workable mix with the use of not less than the cement content of 5½ cu. ft. per cu. yd., and not more than six gallons of water per sack of cement, including the surface water carried by the aggregate. The proportion of fine to coarse aggregate shall be adjusted to produce maximum workability, but in no case shall the ratio of fine to coarse aggregate be less than ½ nor more than 1, i.e., the fine aggregate shall be ⅓ to ½ and the coarse aggregate ½ to ⅔ of the total fine and coarse aggregate. Concrete shall contain not less than 5½ sacks cement per cubic yard and shall have a compressive strength of not less than 3,000 psi at the age of 28 days when cured and tested according to ASTM Specifications.

3.1.2 MIXING - All concrete shall be machine mixed. The ingredients of the concrete shall be mixed to the required consistency and mixing shall be continued at least 1½ minutes after all materials are in the drum before any part of the batch is discharged from the drum. The drum shall be completely emptied before receiving materials for the seceding patch. The volume of the mixed materials for a batch shall not exceed the manufacturer's rated capacity for the drum in cubic feet of mixed materials. The mixer must be equipped with a water storage and measuring device and with suitable discharging hopper. Ready-mixed concrete may be used if it complies with all the requirements of this specification and with ASTM Specification C-94. Concrete shall be so controlled that the slump at all times is a maximum of 4 inches when tested in accordance with ASTM Standards, Designation C143.

3.2 FORMS

3.2.1 MATERIAL - For all surfaces form materials shall be plywood form lining in large sheets and in good condition or metal forms.

3.2.2 CONSTRUCTION - Forms shall be mortar-tight, well braced, tied and supported to maintain the required position for the true shape of the concrete members during and after concrete is placed. Tying of forms with wire shall not be allowed. Snaptie form ties are acceptable.

3.2.3 FORM COATING - Forms shall be coated with a commercial formulated syntheter that will permit the most compaction and shall be worked into all recesses. Ready-mixed concrete shall be placed after mixing and must be in place within one hour after the water has been added to the dry materials. Concrete shall be placed in one continuous operation from construction joint to construction joint.

3.2.4 REMOVAL - Forms shall be removed in accordance with ACI 318. Forms shall not be disturbed until concrete has adequately hardened.

3.3 PLACING CONCRETE

3.3.1 Concrete shall be placed in a manner that will permit the most compaction and shall be worked into all recesses. Ready-mixed concrete shall be placed after mixing and must be in place within one hour after the water has been added to the dry materials. Concrete shall be placed in one continuous operation from construction joint to construction joint.

3.3.2 Concrete shall not be allowed to drop a distance of more than four (4) feet through space.

3.3.3 Concrete shall be vibrated in place by the use of "spud" type internal vibrators with flexible shafts. Vibration shall begin as soon as one batch of concrete has been placed, and shall proceed continuously until the entire section being poured is thoroughly vibrated. Care must be taken to keep the vibrators off the reinforcing steel. Do not over-vibrate or drag vibrator to cause segregation of material.

3.3.4 Concrete shall be placed within the following listed tolerances: Slabs shall not be out of level more than ⅛" in 10' above or below elevation shown.

3.3.5 Roughen contact surfaces of hardened concrete to remove laitance and loose particles of aggregate or concrete and saturate with water before placing adjacent concrete.

3.4 PROTECTION AND CURING

3.4.1 CURING - The Contractor may have the option for either using a curing compound or moist curing the concrete in an approved manner. For moist curing; provide for maintaining the concrete in a moist condition for a period of at least seven (7) days after the placement of concrete. Curing compound shall be Hydrozo Concrete Cure C5309 by W.R. Meadows, Inc., or Chemisil by Chem-Masters Corporation, or an approved equal.

3.4.2 PROTECTION - All concrete must be protected from premature drying from rain and injurious action by the sun, wind, flowing water, frost, freezing, and mechanical injury.

3.4.3 COLD WEATHER REQUIREMENTS

3.4.3.1 Adequate equipment shall be provided for heating the concrete materials, and protecting the concrete during freezing or near freezing weather. No frozen materials or material containing ice shall be used. Methods of heating materials and temperatures of placing concrete are subject to approval of the Engineer, if not outlined below. No extension of time will be given because of low weather temperatures.

3.4.3.2 All concrete materials and all reinforcements, forms, fillers, and ground with which the concrete is to come into contact, shall be free from frost. Whenever the temperature of the surrounding air is below 40° F., all concrete placed in the forms shall have a temperature of between 70° and 80° F., for at least three (3) days or 50° F., for at least five (5) days, except when high early strength concrete is used, the temperature shall be maintained at 70° F., at least two (2) days or 50° F., for three (3) days. Covering must allow air circulation around all surfaces (including

top of slab) of concrete. No dependence shall be placed on salt or other chemicals for the prevention of freezing.

3.5 CLEANUP - On completion of this Contract, clean down all exposed concrete work and remove from the premises form lumber, cement sacks and any debris caused by this work.

END OF SECTION

DIVISION 9 - FINISHES
SECTION 9R - PAINTING OF WATER TANKS

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of providing all materials, labor, equipment, and services required for all painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as herein specified.

1.3 All materials delivered to the jobsite shall be in the original sealed and labeled containers of the paint manufacturer.

1.4 All coatings shall be applied during good painting weather. Air and surface temperatures shall be within the limits set forth by the manufacturer for the coatings being applied and work areas shall be reasonably free of air-born dust at the time of application and while coating is drying.

PART 2 - MATERIALS

2.1 All materials specified herein shall be manufactured by the Tnemec Co., Inc., North Kansas City, Missouri, and are approved for use on this project.

2.2 Materials specified are those that have been evaluated for the specified service. Products of the Tnemec Co. are listed to provide a standard of quality. Equivalent material of other manufacturers may be substituted on written approval of the owner only. Any requests for substitution shall include manufacturer's literature for each project listing the name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified test data showing results to equal the performance criteria of the products has been used and rendered satisfactory service.

All requests for product substitution shall be made at least ten (10) days prior to the bid date of this project.

All material savings shall be passed on to the owner in the form of contract dollar reduction.

Manufacturer's color charts shall be submitted to the owner at least 30 days prior to paint application. The contractor shall coordinate work so as to allow sufficient time for paint to be delivered to the jobsite.

2.3 Colors, where not specified, shall be as selected by the engineer/owner.

2.4 Series 27 F.C. TYPOXY - an epoxy polymide coating system shall meet or exceed the following test requirements:

ABRASION	Method: ASTM D 4060 Requirements: No more than 175 mg. loss after 1000 cycles.
ADHESION	Method: ASTM 4541 Requirements: Not less than 1000 psi pull, average of three (3) trials. Method: ASTM 3359 (Method B) Requirements: Not less than a rating of 5 average of three (3) trials.
HUMIDITY	Method: ASTM D 4585 (Controlled Condensation) Requirements: No blistering, cracking or delamination of film after 600 hours of exposure.
SALTY-SPRAY (FOG)	Method: ASTM B117 Requirements: No blistering, cracking or delamination of film. No more than 1/16" rust creepage at scribe and no rusting at edges after 3,000 hour exposure.

2.5 Series 75 Endura-Shield III, a high-build acrylic polyurethane enamel shall meet or exceed the following requirements:

ABRASION	Method: ASTM D 4060, CS-17 Wheel, 1,000 grams load. Requirements: No more than 96 mg. loss after 1000 cycles.
ADHESION	Method: ASTM D 3359 (Method B) Requirements: Not less than a rating of 5, average of three tests. Method: ASTM 4541 Elcometer Adhesion Requirements: Not less than 1,000 psi pull, average of three (3) trials.
HUMIDITY	Method: ASTM D 4585 (Condensing Humidity) Requirements: No blistering, cracking or delamination of film after 600 hours of exposure.
SALTY-SPRAY (FOG)	Method: ASTM B117 Requirements: No blistering, cracking or delamination of film. No more than 1/16" rust creepage at scribe and no rusting at edges after 3,000 hour exposure.
QUV	Method: ASTM G 53 Requirements: No blistering, cracking or chalking. Less than 4.0 MacAdam units color change after 1,500 hours exposure.
EXTERIOR EXPOSURE	Method: Exposed at 5 degrees facing south. Location: South Florida marine exposure.

Requirements: No blistering, cracking, chalking or delamination of film. Less than 5.0 MacAdam units color change after 2 years exposure.

SURFACE BURNING CHARACTERISTICS

Independent laboratory tests conducted in accordance with ASTM E84-77 have been conducted on various coating systems that included one or more coats of Endura-Shield III. All systems meet the NFPA (National Fire Protection Association) No. 101, Class A requirements pertaining to Flame Spread and Smoke Density. Test results are available upon request.

Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these test results will reflect hazards presented under actual fire conditions.

PART 3 - APPLICATION

3.1 Material shall be mixed, thinned and applied according to the manufacturer's printed instructions.

3.2 Allow each coat to dry thoroughly before applying the next coat.

3.3 Finish coats shall be uniform in color and sheen without streaks, runs, sags or misses.

PART 4 - ACCEPTANCE OF WORK

4.1 Request acceptance of each coat by engineer/inspector before applying the next coat.

4.2 Correct work that is not acceptable and request reinspection by engineer/inspector.

PART 5 - PAINTING SCHEDULE

5.1 EXTERIOR STEEL

Surface Preparation: All surfaces shall be cleaned in accordance with SSPC-SP6 Commercial Blast Cleaning: The existing exterior systems contain chromium. Blasting shall be done with Black Beauty Grit system with 4% by weight peerless metal powder on standpipes #1 and #2 and 6% by weight of peerless metal powder for standpipe #3. Note: These mixtures are recommendations only, actual mixture should be verified by contractor to unsure a "special waste" classification and shall be disposed of in accordance with SSPC - Guide 7I. Also, the contractor will be required to provide landfill tickets to the owner before final payment will be made. The contractor shall notify owner and engineer at such time as the contractor deems surface preparation equal to or greater than SSPC-SP6 before surface is painted.

5.2 APPLICATION

5.2.1 Standpipes No. 1 & 2

Prime Coat: Apply one full coat of Tnemec Series 27 F.L. Typoxy at 4.0 - 6.0 mils Dry Film Thickness.

Finish Coat: Apply one full coat of Tnemec Series 75 Endura-Shield Tank White AA83 at 2.0 -3.0 mils Dry Film Thickness.

5.2.2 Standpipe No. 3

Prime Coat: Apply one full coat of Tnemec Series 66 Hi Build Epoxoline color (or Series 161 Tnemec-Fascure-color) at 4.0 - 6.0 mils Dry Film Thickness.

Finish Coat: Apply one full coat of Tnemec Series 75 Endura-Shield (color) at 2.0 - 3.0 mils Dry Film Thickness. Letter in Series 75 with 2 coats of Black AB-05 - or as required for uniform coverage.

Clear Coat: Apply one full coat of Tnemec 76 Endura-Clear at 1.0 - 2.0 mils Dry Film.

END OF SECTION

DIVISION 13 - SPECIAL CONSTRUCTION
SECTION 13C - HYDROPNEUMATIC AND BLADDER PRESSURE STEEL TANKS FOR WATER STORAGE

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of providing all labor, tools, material, equipment, services and accessories required to provide a complete potable water hydropneumatic tank system.

1.3 STANDARDS - The design, fabrication and inspection shall comply with Section VIII of the ASME boiler and pressure vessel code for unfired pressure vessels with only the plate steel in table UCS-23 of said code being used. The tank shall be stamped for the maximum working pressure of the tank and be hydrostatically tested @ 1-1/2 times the maximum working pressure.

1.4 DESIGN PARAMETERS - Hydropneumatic storage tank shall have a minimum capacity of 5,000 gallons. The tank shall be capable of providing a minimum static pressure of 75 pounds per square inch at ground level.

1.4.1 The pressure tank shall have a capacity of 7,500 gallons and shall have a rubber pressure bladder. The tank and bladder shall be capable of providing a minimum static pressure of 75 pounds per square inch at ground level.

1.5 SUBMITTALS - The contractor shall submit to the engineers for their approval six (6) copies of complete detailed information including shop drawings, descriptive literature and any other pertinent data relating to the equipment being furnished. It shall include but not limited to the following:

A. Certified drawings;
B. Motor data as described in part 2 products;
C. Performance curves;
D. Foundation and installation plans; and
E. Wiring and piping schematics.

1.6 The Contractor shall guarantee the structure against any defective materials or workmanship, for 10 years from the date of completion. If any materials or workmanship prove to be defective within the guarantee period, they shall be replaced or repaired by the Contractor. Paint and painting shall be guaranteed against any defective materials or workmanship for 1 year from the date of completion.

A separate control panel shall be provided and shall include air compressor motor starter, main and control breakers, transformer, level and solenoid valve relays, terminal strip, dry remote contacts enclosed in a NEMA #4 steel enclosure suitable for wall or free standard mounting. The control panel shall be of the annunciating type and shall include air compressor elapsed time meter, power on light (red), compressor run light (green), compressor high air temperature and low oil pressure light (red), hydropneumatic tank low and high level alarm (red), low air pressure alarm (red) and air compressor and add air solenoid valve HOA switch.

PART 2 - MATERIALS

2.1 HYDROPNEUMATIC TANK - The hydropneumatic tank shall be of steel construction ASME code and stamped for 100 psi W.P. and have a nominal capacity of 5,000 gallons. It shall be 6 feet diameter by 25 feet overall length and be mounted on two steel saddles welded to the tank shell. The tank shall be furnished with an ASME approved safety valve, vacuum relief valve, pressure gage, combination probewell and level gage. The tank shall be furnished with the following accessories: Drexelbrook multipoint level control with remote controller as shown on the drawings, air add solenoid valve 115/1/60 NEMA #4 enclosure, one (1) 14" x 18" manway and two steel lifting lugs. The interior shall be epoxy coated for potable water service, the exterior sandblasted and primed. The tank shall be of the horizontal type, materials for the design, fabrication and inspection shall comply with Section VIII of the ASME boiler and pressure vessel code for unfired pressure vessels with only the plate steel in table UCS-23 of said code being used. The tank shall be stamped for the maximum working pressure of the tank and be hydrostatically tested @ 1-1/2 times the maximum working pressure.

Provide flanged inlet and outlet and all threaded accessory outlets as shown on the drawing. The interior shall be finished coated by the manufacture prior to shipment, the exterior finish coat shall be applied in the field after the tank is installed by others.

2.2 AIR COMPRESSOR - Furnish one tank mounted air compressor with sufficient capacity to operate the hydropneumatic tank system. It shall be supplied with an air-cooled aftercooler, high air & low oil pressure shutdown switch, pressure gage, safety valve, automatic condensate drain and service valve. It shall be of the reciprocating type two stage air cooled with cast iron cylinders. It shall have large intercooler tubes to cool the air between stages. A pressure lubrication system with filter and a dry type inlet filter silencer. Automatic start and stop control, hydraulic positive unloading to insure the motor does not start under load regardless of the discharge pressure. The unit shall be supplied with a 5.0 HP 230/460/3/60 open dripproof electric motor with a 1.15 service factor which shall not be used throughout the entire operating range. A 3.0 micron, filter and check valve shall be furnished for field mounting in the compressor discharge line. The compressor and motor shall be mounted on an 80 gallon ASME 200psi. receiver and housed in a steel weather-proof enclosure with air vents and double doors. Quincy Model QR25 or approved equal.

2.3 CONTROL PANEL - Furnish a control panel to operate the compressor and the hydropneumatic tank air volume system. A separate control panel shall be provided and shall include air compressor motor starter, main and control breakers, transformer, level and solenoid valve relays, terminal strip, dry remote contacts enclosed in a NEMA #4 steel enclosure suitable for wall or free standing mounting. The control panel shall be of the annunciating type and shall include air compressor elapsed time meter, power on light (red), compressor run light (green), compressor high air temperature and low oil pressure light (red), hydropneumatic tank low and high level alarm (red), low air pressure alarm (red) and air compressor and add air solenoid valve HOA switch.

2.4 OPERATING INSTRUCTIONS

2.4.1 Operating and installation manuals shall be furnished for each piece of equipment at time of delivery.

2.4.2 A representative who has complete knowledge of the installation, operation and maintenance of the equipment and the complete system shall be on site for not less than two (2) days to inspect the installation, supervise initial startup, run field tests and instruct the owner's personnel.

2.5 TOOLS AND SPARE PARTS

2.5.1 The air compressor shall be supplied with the following spare parts and special tools if required for the normal operation and maintenance of the unit:

A. Special tools, if required;
B. One complete set of gaskets;
C. Two inlet filter elements;
D. Two oil filters; and
E. One set v-belts.

2.5.2 All spare parts shall be packed in containers clearly marked as to it's contents, duplicate parts shall be interchangeable.

2.5.3 An itemized list of all spare parts shall be included in parts list and instructions as specified in 1.04.

2.6 INSPECTION AND TESTING

2.6.1 The system supplier shall furnish the services of a qualified representative to inspect the installation, supervise initial start-up, run field tests and instruct the owner in the proper operation and maintenance of the equipment and the complete system.

2.6.2 An operational run test of all equipment and the complete system shall be made to provide satisfactory operation. The engineers may operate the system to simulate normal and extreme operating conditions.

PART 3 - EXECUTION

3.1 All painting of the tanks shall be completed in accordance with AWWA D102 utilizing the paint systems specified herein. At completion of painting and prior to disinfection, the paint system shall be tested and a written report submitted in accordance with AWWA D102 Section 8.

3.2 Prior to filling with potable water, the tanks shall be disinfected in accordance with AWWA C 652. Two (2) or more consecutive samples shall be collected and analyzed to indicate microbiologically satisfactory water. Upon completion of disinfection the chlorinated water shall be disposed of properly and not discharged into the potable water system.

3.3 Upon completion of all work, the Contractor shall remove all equipment and debris from the site and restore it to its previous condition.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15J - WATER MAIN

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - The work under this section consists of furnishing all plant, labor, equipment, appliances, and in performing all operations in connection with the installation of underground water main construction as shown on the plans, complete in place and ready for service.

1.3 TESTING - All testing shall be done by an independent testing laboratory, provided by the Contractor and approved by the Engineer prior to construction. All test results shall be submitted in a timely manner to the Engineer. Failure to submit in a timely manner may result in the suspension of work.

PART 2 - MATERIALS

2.1 PVC PIPING - Pipe shall be extruded from PVC meeting the requirements of cell classification 12454-A or 12454-B as defined in ASTM D1784. Pipe shall be approved by National Sanitation Foundation for use in potable water pipe. Pipe shall be manufactured to steel pipe size (IPS) outside dimension with DR's and tolerance in compliance with ASTM D2241. Joints shall be in compliance with ASTM D 3139. Pipe shall be Class 200 PVC, DR 14.

All piping less than 3 inches in diameter shall have minimum 200 psi rating and conform to SDR-21.

2.2 GATE VALVES - shall be designed for a working pressure of not less than 200 pounds per square inch. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counter-clockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

2.2.1 Valves smaller than 3 inches shall be all bronze and shall conform to Federal Specification WW-V-54, Type 1, Clas B.

2.2.2 Valves 3 inches and larger shall be iron body, double-disc, non-rising stem, bronze mounted, and shall conform to AWWA C500. Valve ends shall be of the mechanical joint type or of the push-on type conforming to ANSI A21.11 except where flanged ends are required by plans or specifications. Valves shall be provided with stem seals of the "O" ring type. Two "O" rings shall be used with at lest one "O" ring inserted above the thrust collar. The packing plate shall be attached to the valve bonnet with not less than three (3) bolts. Valves shall be equipped with a 2-inch square wrench nut.

2.3. CHECK VALVES

2.3.1 Valves 2" and less shall be designed for a minimum working pressure of 200 pounds per square inch. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. Distinctly cast on the body of each valve shall be the manufacturer's name, or initials, or trademark by which he can be readily identified, and also the size of the valve, working pressure, and the direction of flow.

2.4.2 Valves larger than 2 inches shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125 pound type conforming to ANSI B16.1.

2.5 VALVE BOXES - Shall be cast iron adjustable valve boxes of size as required for valve. Lids shall be marked "Water."

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER PIPING - Proper and suitable tools and appliances for the safe and convenient handling and placing of the pipes, specials and valves shall be used. All pieces shall be carefully laid. If any defective piece should be discovered after having been laid, if shall be removed and replaced with a sound piece, in a satisfactory manner, by the Contractor at this own expense. The pipes, specials, and valves shall be thoroughly cleaned before they are placed, shall b kept clean until they are accepted in the completed work, and when laid shall conform accurately to the lines and elevations given by the Engineer or as specified.

3.2 Water main shall be laid a minimum of 10 feet horizontally from all existing sewer lines. Distance shall be measured from edge to edge. When the water main must be laid crossing a sewer main vertical distance of 18 inches shall be maintained between the outside of the water main and sewer. Crossings shall be arranged that joints will be equal distance and as far as possible from the sewer main.

3.3 Underground water pipe shall be laid and the work incidental thereto performed in accordance with the current revisions of AWWA C600, "Standard for Installation of Cast Iron Water Mains", and the supplemental requirements specified herein. It shall be expressly understood that all pertinent and applicable portions of the above named specifications shall apply to all underground pipe work (Cast iron and other materials) within scope and intent of this section of the project specifications and not only to "Cast Iron Water Mains". Unless otherwise indicated or ordered, all piping shall be installed with three (3) feet of cover over the top of the pipe.

3.4 The trench shall be dug so that the pipe can be laid to the alignment and depth required, and the trench shall be of such width and shall be so braced and drained that the workmen may work therein safely and efficiently. The trench bottom shall be adequately graded so that the pipe barrel will have continuous support when placed thereon. No blocking under pipe will be permitted. All joints shall be as specified hereinabove. Valves shall be provided with a concrete foundation of one cubic foot volume minimum laid directly on undisturbed or compacted soil. All plugs, caps, tees, and bends on cast iron pressure lines shall be provided with an adequate concrete reaction backing placed between solid ground and the fitting to be anchored in a manner acceptable to the Engineer. If required, the pipe shall be tested as hereinafter specified before the trench is backfilled.

3.5 Backfill shall be of excavated material, exclusive of organic material, boulders, broken pavement or similar materials. Backfill shall be placed the full width of the trench and compacted by approved mechanical means in accordance with the Earthwork for Utilities Section in Division 2.

3.6 CONNECTIONS TO EXISTING PIPE LINES - All connections to existing pipe lines shall be made in a manner to meet the approval of the Engineer and in accordance with standard methods and accepted good practice. The method and time of making such connections shall be scheduled in advance and shall be approved by the Engineer prior to the start of work on the said connection. No undue interruptions of existing services or operations shall be permitted.

3.7 TESTING OF WATER PIPING - The inside of all pipe, valves and fittings shall be smooth, clean and free from blister, loose mill scale, sand, etc., when erected. All lines shall be thoroughly clean and blown before placing in service. Testing shall be made by and at the expense of the Contractor in the presence, and to the satisfaction of the Engineer, if conditions will permit, and before the line is backfilled or otherwise concealed.

3.7.1 Water supply piping shall be tested under a pressure of 150 psi and shall remain absolutely tight at this pressure for a period of one (1) hour. Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to the Engineer. All fixtures, devices, or other accessories which are to be connected to the lines and which would be damaged if subjected to the specified tests shall be disconnected as required,and the ends of the branch lines plugged or capped as required.

3.7.2 STERILIZATION - After pressure tests have been made, the water distribution system shall be thoroughly flushed with water until all entrained dirt and mud have been removed, and shall be thoroughly sterilized with a solution containing not less than 100 parts per million of available chlorine. The solution shall remain in the system for two (2) hours during which time all valves in the system shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than the chlorine level of the available water supply. Contractor shall take care in flushing the chlorine to the drains to avoid damage to topsoil and seeding. Testing shall be done by an Independent Testing Laboratory.

3.8 TESTING AND ERECTION OF VALVES - All valves shall be tested in place so far as practicable under the conditions specified and any defects revealed in valves or connection under tests shall be corrected to the satisfaction of the Engineer. All valves shall be carefully erected in their respective positions, free from all distortions and strain, with joints made as specified, and shall be left in satisfactory operating condition. All stem guides shall be accurately aligned.

END OF SECTION

DIVISION 16 - ELECTRICAL
SECTION 16A - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 NOTICE - Provisions of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of providing all labor, materials, equipment, and services required for completion of all electrical work as shown on the drawings and specified herein.

1.3 The Contractor shall be responsible for all of his work, fitted into place in a satisfactory and neat workmanlike manner in every particular to the approval of the Engineer.

1.4 Confer with the Contractor regarding the location and size of pipes, equipment, fixtures, conduit, ducts, openings, switches, outlets, etc., in order that there be no interferences between the installation of the various trades items on the project. The Architectural Drawings shall take precedence over the Electrical Drawings.

1.5 The Electrical Drawings are diagrammatic and shall be followed as closely as actual construction of the building and the work of other trades will permit. All changes from Drawings necessary to make the work of each trade conform to the building construction and the work of the other trades shall be done at the Contractor's expense.

1.6 The Owner reserves the right to change the location of any equipment five (5) feet and any piping or conduit ten (10) feet in any direction without extra charge, provided such changes are made before installation.

1.7 Unless explicitly stated to the contrary,the Contractor shall furnish and install each item of equipment or material hereinafter specified, complete with any and all necessary fittings, supports, trim, piping, insulation, etc., as required for a complete and operating installation.

1.8 All equipment and materials shall be installed according to the manufacturer's instructions unless otherwise specifically directed by the Contract Documents.

PART 2 - STANDARDS, LAWS AND ORDINANCES

2.1 Supplementing the requirements of the General Conditions for compliance with laws and ordinances, the work shall meet or exceed the requirements of the following:

2.1.1 Electrical Equipment and Wiring - National Electric Code

2.1.2 Heat Producing Appliances - BOCA Code

2.2 All products and equipment shall meet UL requirements. Contract Documents shall govern whenever they exceed applicable code requirements.

PART 3 - SHOP DRAWINGS

3.1 Furnish complete shop drawings and/or catalog data on all major items of material and equipment PRIOR to starting work.

3.2 Each group of shop drawings submitted shall be accompanied by an itemized letter of transmittal itemizing: names of items, manufacturer, itemizing symbols used on the Drawings.

3.3 Bind each group of shop drawings in a heavy paper binder acceptable to the Engineer.

3.4 The Contractor shall use a rubber stamp or shall apply labels to label each drawing with the following information: Date, Project Name, Project Address, Contractor's Name, Contractor's Address, Contractor's Approval Stamp and Signature, Supplier's Name, Supplier's Address.

3.5 NOTE: Information on the shop drawings must conclusively specify how submitted equipment compares with that specified as to material, capacity, gauges, finish, color, accessories, working pressures, dimensions, insulation, etc.

3.6 Catalog cuts showing more than one (1) model of a product must be clearly marked indicating which model is being proposed.

3.7 Capacity and performance data shall be given in the same form, units and completeness given in Contract Documents.

3.8 Identifying symbols used on drawings shall be clearly cross referenced on shop drawings.

3.9 Contractor shall carefully review, check and stamp his approval on all shop drawings before submitting them to the Engineer. Shop drawings submitted to the Engineer directly by suppliers WILL BE RETURNED WITHOUT ACTION.

PART 4 - OPENINGS AND SLEEVES IN CONSTRUCTION

4.1 The openings required in wall, floor, roof, ceiling, etc., construction for Electrical work will be provided by the Contractor. All sleeves, inserts, forms, etc., required for openings shall be furnished by the Contractor. The Contractors shall be responsible for their size, fabrication and location.

4.2 Sleeves shall be provided wherever pipes or electrical conduit pass through walls or floors. In placed concrete or masonry, sleeves shall be Schedule 40 PVC pipe. Sleeves in foundation walls shall be Schedule 40 steel pipe. In most other locations, sleeves may be 20 gauge galvanized sheet metal.

4.3 Floor sleeves shall finish flush in all rooms except chases, toilet rooms, equipment rooms, etc., where they shall project one inch (1") above floor and shall be neatly beveled. Wall sleeves shall finish flush with wall lines. Inside diameter of sleeves shall be ¼" to ½" larger than outside diameter of conduit or pipe passing through same.

4.4 Caulk all sleeves "sight tight" with white oakum and caulk each face. Caulk sleeves in foundation walls with gun grade joint filler.

4.5 For roof openings for pipes, conduit, etc., furnish and install at each such installation proper roof sleeve and three (3) lb. lead flashing extending 12" all directions under roofing and up pipe or conduit to water-tight clamp and flashing assembly.

PART 5 - EXCAVATION AND BACKFILLINGS

5.1 The Contractor shall do all excavating, sheeting, bracing, and backfilling required for the installation of any and all parts of his respective work. Each bidder shall visit the premises and determine for himself, at his own expense, by actual observation, boring or other means, the nature of the soil condition. Excavate solid rock or in ground water conditions at no increase in contract price, except as specified in the Contract Documents.

5.2 Piping, conduit, etc., shall be bedded firmly and continuously on undisturbed earth (or sand or pea gravel where specified or required). Where piping has bells, excavate deeper at same.

5.3 Where the excavation is in rock, ashes, cinders, refuse or other unsuitable materials, make the trench 6" deeper and 12" wider than required for the piping and backfill with approved sand or pea gravel 6" deep. In these areas provide 6" sand or pea gravel backfill around entire perimeter of pipe, conduit, etc.

5.4 Maintain all trenches and excavations free of standing water. DO NOT backfill any trench until pressure tests have been completed, the joints and pipe have been found to be water-tight, and the Engineer, Electrical Inspector, etc., have approved same. Backfill all trenches in 8" layers and compact by tamping and puddling. Backfill material shall not be frozen.

5.5 Backfill for the first 12" over piping etc., shall be placed by hand and carefully tamped.

5.6 Use sand or pea gravel fill for trench backfill under floors, parking lots, walks and drives. Backfill any over- excavation to proper level with sand or pea gravel, thoroughly compacted. Where pipe must be laid in backfill of other construction, remove same to undisturbed earth and backfill with sand or pea gravel to proper level.

5.7 Surplus earth may be used for backfill in yard areas of project upon approval of the Engineer. No cinders, ashes, wood, large rocks, concrete or debris will be allowed in the backfill. Surplus excavation material not needed for backfill or elsewhere on the site shall be promptly removed from the site by the Contractor.

5.8 Provide adequate barricades, construction signs, torches, red lanterns, guards, etc., as required during the progress of the excavation work. Observe all applicable regulations respecting safety provisions, sheeting, barricades, etc.

5.9 Protect utilities, trees, shrubbery, fences, poles, sidewalks, curbs, and all other property and surface structures from damage. Any items which are disturbed shall be restored by the Contractor at his own expense.

5.10 Whenever excavations are made through streets, lawns, sidewalks, parking areas, curbs, or other finished surfaces, replace such surfaces with material to match existing surfaces approved by the proper authorities, including reinforcing steel where required. All cuts shall be neatly done with saws, etc.

5.11 Whenever excavations are made through existing grassed areas, Contractor shall seed or sod to match existing.

5.12 Before beginning excavation work Contractor shall contact utility companies and request that they locate and stake buried piping, wiring, etc. Such piping, wiring, etc., shall be exposed by hand excavation prior to the use of power equipment.

PART 6 - ESCUTCHEONS

6.1 Install escutcheons on all exposed pipes and conduits passing through all sleeved or un-sleeved openings in floors, walls, ceilings, roofs, etc., of all finished rooms including inside cabinetry in finished rooms.

6.2 Escutcheons may be deleted in:

6.2.1 Equipment Rooms

6.2.2 Pipe Chases

6.2.3 Janitor Rooms

6.2.4 Where Engineer has given written approval.

6.3 Escutcheons shall be equal or greater to Grinell #1 or #10, with the following finishes: Walls and ceilings - prime coat paint; Floors chrome plated.

PART 7 - WIRING OF MECHANICAL EQUIPMENT AND MOTORS

7.1 Unless otherwise specified, the Contractor will furnish and install all conduit, wiring, disconnects, starters, thermal overload heaters, holding coils, remote push-button stations, hand-off-auto and multi-speed switches, and pilot lights for all electrically operated-mechanical equipment, including final connections to same, as shown on the drawings and as hereinafter specified, leaving same ready for operation.

7.2 The contractor shall coordinate the motor type, voltage, and size with the starter type, voltage and size, holding coil voltage, thermal overload capacities, interlocks, etc., and shall be equally responsible to insure that the equipment installed is of proper size and type.

7.3 After wiring is completed, the Contractor shall inspect said wiring before motors are operated. If any discrepancies are discovered, notify the Engineer in writing of said discrepancies. The Engineer will arrange to have changes executed as required. After any required changes are complete, the Contractor shall assume complete responsibility for motor protection during the warranty period including initial start-up of each motor.

PART 8 - MAINTENANCE MANUALS

8.1 Furnish for approval two (2) complete Maintenance Manuals for all materials and equipment. Each manual shall include:

8.1.1 Owner's copy of all approved shop drawings

8.1.2 Wiring diagrams

8.1.3 Operating Instructions

8.1.4 Lubrication Instructions

8.1.5 Maintenance Instructions

8.1.6 Parts List

8.1.7 Test Reports

8.2 Each manual shall be 8½" x 11" hard cover 3-ring binder style; have divider leafs with index with index tabs; be fully labeled in large letters on edge and front; list names and addresses of Project, Contractor, Engineer, etc.

PART 9 - OWNER INSTRUCTION

9.1 It shall be the responsibility of the Contractor to furnish all testing equipment and labor necessary to perform the following tests:

9.2 After wires or cables are in place, but before being connected to devices and equipment, the system shall be tested for shorts, opens, intentional and unintentional grounds by means of an approved type of constant "Megger". All hot wires in conduit that shorted or unintentionally grounded shall be replaced.

9.3 A voltage test shall be made on the last outlet of each branch circuit and the potential drop shall not exceed 2%. Voltage drops for panel and large feeders shall not exceed 3% hence the total voltage drop for a feeder and any branch circuit shall not exceed 5% of the service voltage. The test shall be made under design load, or its equal.

9.4 Test the insulation resistances of all motor windings to ground with a "Megger" before applying line voltage to the motors. If these values are less than 1 megohm,the Contractor furnishing the motor shall be responsible for correcting the error.

9.5 With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate plus or minus 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.

9.6 Any wiring device, lighting fixture, or electrical apparatus in this contract, if grounded or shorted on an integral "line" part, shall be removed and the trouble corrected.

9.7 All tests must be conducted in the presence of the Contractor's Foreman and three (3) typewritten copies of all tests, certified by the Foreman shall be submitted to the Engineer for approval. Test data shall include the name of the building, equipment driven and nameplate data of all integral horsepower motors.

PART 10 - ELECTRICAL REFERENCE SYMBOLS AND ABBREVIATIONS

10.1 In general, The symbols and abbreviations used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of Special Symbols as shown in the schedules or legends.

PART 11 - IDENTIFICATION

11.1 All equipment, such as panels, cabinets, etc., furnished by the Contractor shall be permanently labeled, in an approved manner, corresponding to the mark and name shown on the drawings and/or in the specifications. Label shall include the name of the Contractor. Shop drawings shall indicate label wording, size and location.

11.2 All wire and cable shall be color coded and shall be labeled with tags or tape at each end giving use and circuit number (see wire and cable).

11.3 All devices controlling equipment such as TT switches, disconnects, starters, time switches, special light switches, dimmers, etc., shall be clearly labeled as to what they control.

11.4 All special outlets and/or receptacles rated over 120 volts or whose use is not clear to the layman shall be labeled (i.e.208V-3-30A, etc.)

11.5 In panels, etc., clearly indicate what they feed. This may be accomplished by means of the typewritten panel schedules mounted inside of front cover doors under glass or plastic.

PART 12 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

12.1 Contractor shall demonstrate the use and essential features of the installed Electrical Systems.

12.2 Each system shall be demonstrated once only, after completion of testing and acceptance.

12.3 The demonstration shall be held upon completion and acceptance of all systems at a date and time to be agreed upon in writing by the Owner or his representative.

12.4 The demonstrations shall be held by the Contractor in the presence of the Owner, and/or his representative and the manufacturer's representative if required by the Owner.

12.5 Demonstrate the function and locations (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.

12.6 Demonstrate by "start-stop operations" how to operate the controls, how to reset protective devices, how to replace fuses and what to do incase of emergency.

12.7 Submit a certificate of completed demonstration countersigned by the Owner.

PART 13 - CONCRETE WORK AND PADS

13.1 All concreting, reinforcing, and form work necessary in connection with the construction of pads and the concreting around raceway runs underground shall be provided by the Contractor. Refer to Concrete Division for Concrete forms, materials and other requirements.

PART 14 - FINAL INSPECTION

14.1 Final inspection will be made only after the Contractor certifies in writing that the work is 100% complete.

14.2 An inspection report describing incomplete/unacceptable work will be prepared by the Engineer. This will be reviewed with the Contractor at the project site.

14.3 After the incomplete or unacceptable work is 100% corrected, the Contractor shall so certify in writing to the Engineer.

14.4 At the final inspection, the covers of all panels and main switch gear shall be removed for inspection. The cover removal shall be done in the presence and at the request of the Engineer or his representative.

PART 15 - PROJECT CLOSEOUT REQUIREMENTS

15.1 The following requirements must be fully completed before the final application for payment will be accepted or approved.

15.1.1 Final Inspection

15.1.2 Final Submittals - Submit the following to the Owner (list is not necessarily all inclusive):

15.1.2.1 Maintenance Manual(s.)

15.1.2.2 Owner Instruction Certification Letters.

15.1.2.3 Manufacturer's Letters of Certification.

15.1.2.4 Extended Guarantees (for specific equipment with more than a one (1) year guarantee).

15.1.2.5 Written receipt signed by Owner for ALL loose items turned over to Owner such as:

Electrical panel keys
Extra air filters
Special wrenches, tools, etc.

END OF SECTION

DIVISION 16 - ELECTRICAL
SECTION 16B - BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.1 NOTICE - Provision of General Requirements, Division 1, are a part of this Division and Section.

1.2 SCOPE OF WORK - Shall consist of furnishing all labor, materials, equipment and services required for completion of all electrical systems as indicated on the drawings and specified herein.

1.3 In general, all materials shall be new UL approved and listed for the specific application as specified or as required and be properly installed.

1.4 All work shall be performed in accordance with acceptable industry standards except where specific procedures are called for in these specifications in which case they shall be followed. If not specified, standard methods shall be used. It is strongly suggested all procedures be reviewed with the Engineer prior to beginning the work in order to avoid changes costly to this contractor.

1.5 Comply with the NEC, all applicable state, federal and local codes. This Contractor and his employees shall be responsible for helping to accomplish this end. Should it be determined that there is a violation in the design Contract Documents, it shall be brought to the attention of the Engineer prior to starting the work. The local enforcing authority shall be the interpreter of any code requirements and this Contractor shall comply with these requirements. In the absence of a local authority, the Engineer shall interpret the codes and his decision shall govern.

1.6 The following work is necessary for the satisfactory operation of this system, but is not included as part of the Contractor's work and will be done in other sections of these specification.

1.7 All motors, unless otherwise specified herein, shall be furnished and set in place by the Contractors.

1.8 Telephone system wires, cable, equipment, and instruments will be furnished and installed by the Owner. Contractor shall coordinate with the Owner for installation.

PART 2 - CONDUITS, FITTINGS, AND INSTALLATION

2.1 All wiring shall be in NEC approved raceways sized as shown on drawings, or, if not sized on the drawings, in accordance with the 1990 Edition of the NEC except that NO conduit smaller than ¾" shall be allowed on "home runs". All raceways shall be concealed unless otherwise shown.

2.2 Conduit and elbows shall be as manufactured by G.E., National Electric, Youngstown or approved equal. Conduit fittings and couplings shall be as manufactured by the Appleton Company or approved equal.

2.3 Prior to roughing-in, the Contractor shall coordinate the installation of conduit and outlets with other trades. To avoid interferences, in areas where numerous ducts, pipes, etc., occur, conduit and outlets shall be installed after the other mechanical trades have completed their work.

2.4 Concealed conduits shall be run in a direct line with long sweep bends and offsets. All horizontal runs shall be run with a slight incline, to prevent low spots or pockets, for drainage.

2.5 Conduits shall be continuous from outlet to outlet, from outlets to cabinets, pull or junction boxes and shall be secured to all boxes with locknuts and bushings in such a manner that each system shall be electrically continuous throughout. Conduit ends shall be plugged with "pennies" to prevent entrance of foreign materials during construction. Erickson couplings shall be used where required. No running threads shall be cut.

2.6 On all conduit 1" trade size and larger, bushings shall be of the insulated type as manufactured by Appleton or equal. Provide grounding type for panel feeders.

2.7 All conduit systems must be installed complete before conductors are "pulled-in". Conduits shall be securely supported at proper intervals to building structure with steel clamps, or conduit hangers or by supporting assemblies as shown on the drawings. (SEE CONDUIT, SUPPORT AND HANGERS.)

2.8 For 1" conduit and larger, hickey bends will not be acceptable. Either manufactured elbows or bends fabricated in a bending machine shall be used. The radius of the curve of the inner edge of any bend shall be six (6) times the internal diameter of the conduit, or larger, at the bend of synthetic or braided wires. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four (4) quarter bends, including those bends located immediately at the outlet or fitting for braided wires. (12 times diameter for 3" and larger size.)

2.9 No conduit shall run above or adjacent to steam or water piping, and must be individually supported.

2.10 In portions of wet locations, and in locations where walls are frequently washed, the entire conduit system, including all boxes and fittings used therewith, shall be so installed and equipped as to prevent water from entering the conduit, and the conduit shall be so mounted so that there is at least 1/4" air space between the conduit and the wall or similar supporting surface. All supports, bolts, straps, screws, etc., in such locations shall be of corrosive-resistant type.

2.11 All conduit in hazardous areas shall conform to NEC requirements for those areas and where feeding from or to a hazardous area to another room "seal-offs" shall be used.

2.12 Three (3) spare ¾" conduits shall be stubbed into the joist space for all flush mounted panels.

2.13 Rigid metal conduit shall be used under concrete construction or in moist areas and for service entrance work. Rigid NON-METALLIC conduit acceptable, if allowed by local code FOR SERVICE ENTRY FEEDERS ONLY.

2.14 All rigid metal conduits shall be hot dipped galvanized rigid steel or heavy wall steel pipe, bear the UL label, and meet UL Standard #6. All conduit shall be cut square, threaded, reamed smooth and drawn tight in that order. Bends or offsets shall be made with standard conduit.

2.15 When rigid metal conduit is installed in concrete or underground, it shall have joints sealed with white lead and concrete covering. All conduit openings shall be temporarily plugged to exclude water and concrete infiltration. All conduits shall be swabbed before conductors are "pulled-in". If rigid metal conduit is buried in cinders, it shall be encased on all sides with three inches (3") of concrete.

2.16 Exposed conduits shall be installed at right angles to the building lines; all breaks and turns being made with malleable iron cadmium or hot galvanized conduit fitting with malleable iron or hot dipped galvanized covers. Exposed bends shall be used only where approved by the Engineer. Covers to be secured to bodies with brass machine screws. All conduit fittings shall be as manufactured by Appleton Electric Company, Crouse-Hinds, Killark or approved equal. Approval of the Engineer must be obtained for location and aesthetics of each and every run of exposed raceway prior to installation.

2.17 Where "galvanizing" is mentioned in this specifications. it shall be zinc hot dipped galvanizing in accordance with ASTM Standard A-153, and the galvanizing shall be after fabrication. All hot dipped galvanizing shall be uniform in density, free from all fractures and dirt pockets, and shall present a neat and workmanlike appearance.

2.18 Electrical Metallic Tubing (EMT) or "Thinwall" (TW) may be used where permitted by NEC, except in areas where rigid metal or IMC is required by these specifications.

2.19 All thinwall conduit shall be of open hearth, cold rolled. strip steel tubing, of standard sizes and weights, especially selected with reference to uniformity and freedom from defects, have each length stamped with manufacturer's name and trademark, and bear underwriter's stamp, have inner wall of conduit coated with one (1) or more coats of enamel baked on, of such consistency that it will not become soft or sticky and prevent free insertion or withdrawal of conductors, have electrically welded seams, and on outside electrically galvanized or similar finish, be highly resistant to the corrosive effect of moisture, alkali, dirt, dust and other injurious agents.

2.20 All thinwall conduit fittings shall secure to conduit by a compression fitting. Other methods for securing are not acceptable.

2.21 All conduit shall: have openings temporarily plugged to exclude plaster or other foreign materials; be installed by using water-tight joints made by use if an approved fitting as specified before; be no smaller than ¾", unless otherwise shown on drawings or specified herein; be run concealed; be reamed after cutting; have joints cut square, and butt solidly into fittings; have the ends terminated in a proper fitting, and all fittings shall be of water-tight type; be rigidly supported so as to prevent undue stress or strain on the coupling and connectors.

2.22 Flexible metal conduit shall be Greenfield type in dry locations with squeeze-type connectors, be "seal-tight" in all wet locations with Appleton "Sealtite" ferrule and sleeve type connectors, may be used for all final connections to motors and recessed light fixtures, as is applicable to NEC.

PART 3 - CONDUIT SUPPORT AND HANGERS

3.1 All conduits shall be securely fastened in place at maximum of 8 foot intervals 1" conduit or less and 5 foot intervals 1" conduit and larger. Hangers and supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted.

The required strength of the supporting equipment and size and type of anchors shall be based on combined weight of conduit, hanger and conductors. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other approved devices with suitable bolts, expansion shields (where needed) or beam clamps, for mounting to building structure or special brackets.

3.2 On concrete or masonry construction, insert anchors shall be installed equal to Ackerman-Johnson, Paine, Phillips with round head screws. An electric or hand drill shall be used for drilling holes for all inserts in concrete, masonry or similar construction. In masonry, inserts shall be near center of masonry unit, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust resisting metal or equal.

3.3 The Contractor shall lay out his work in advance of the laying of floors or walls, and shall furnish all required sleeves for installation. Where called for on the drawings, conduit to be run exposed, the Contractor shall furnish and install inserts and clamps for the supporting of conduit. If the Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching later, at his own expense, to the satisfaction of the Engineer.

PART 4 - INSTALLATION OF CONDUIT UNDERGROUND

4.1 All underground conduits shall be rigid metal (steel) conduits. At Contractor's option and local codes permitting, underground conduit installed under parking lot(s) and main service entry to main panels under floor, may be non-metallic conduit.

4.2 All conduits shall have centers no greater than 12" apart and minimum of 24" below finished grade; be pitched to drain away from building; have runs separated and supported, prior to backfilling on plastic or pre-cast concrete block filling intermediate spacers; have long radius bends instead of standard elbows; have approved insulated metallic bushings at point of entry; have coupling staggered at least 1 foot apart; have duct seal around conductors entering or leaving and when empty shall be capped with an approved plug.

4.3 Where conduits, ducts, etc., pass under sidewalks, roads or curbs, this Contractor shall use rigid metal (steel) conduit (see option above) maintaining the proper slope and drainage. The conduit shall extend at least three feet (3') on either side of the road etc.

4.4 Before the Contractor pulls any conductors into the underground conduits, he shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit, and if any concrete or obstructions are found, the contractor shall remove them and clear the conduits. All underground conduits shall be swabbed before conductors are pulled in.

4.5 Conduit excavations parallel to walls shall NOT BE PERMITTED WITHIN 18", HORIZONTALLY OF FOOTINGS.

PART 5 - WIRE AND CABLE

5.1 All cable and wire shall comply with the latest specifications and requirements of the NFPA and/or the Insulated Power Cable Engineers Association and shall be of same quality as manufactured by Triangle, Cresent, General Cable, General Electric, Universal or equal and conform to the following, unless otherwise specified, noted on the drawings or required:

5.1.1 All conductors for wire and cable shall be copper based on 98% conductivity according to Mattheisen's Standard, and shall be tinned or untinned in accordance with established standards for the type of insulation around the conductors. Stranding and materials of conductors shall be in accordance with ASTM Designation B8 and B33. No. 10 AWG and smaller shall be solid and No, 8 AWG and larger shall be standard.

5.1.2 All wire and cable shall be stamped approximately every two feet (2') and indicate voltage, type, temperature rating, etc.

5.1.3 All cable shall be rated 600 volts unless otherwise specified.

PART 6 - INSTALLATION & APPLICATION OF WIRES & CABLES (600 VOLTS)

6.1 All cable or wire shall be 600 volt; be installed in approved raceways or conduit; be not less than #12 AWG except that #14 AWG may be used for control and low voltage wiring, and have THW insulation.

6.2 All internal fixture wiring shall be minimum #14 AWG, type AF or TF (150 degrees Centigrade) with minimum 300 volt insulation.

6.3 All branch circuit wiring from panels to any outlet on the circuit over 50' but under 100' in length shall be #12 AWG for the first half of the circuit, over 100' but under 175' use #10 AWG for first half.

6.4 All branch circuit wiring shall be done with color coded conductors, using the same code throughout as follows:

Mechanical Ground-Green
Neutral 208/120 - White
Phase A 208/120 - Black
Phase B 208/120 - Red
Phase C 208/120 - Blue
Single & 3-way Return - Orange Tracer
3-Way Traveler - Yellow Tracer
Start Control - Black Tracer
Stop Control - Red Tracer
Hold Control - Brown Tracer

6.5 Colors as selected for the purpose of identifying circuits shall be applied to the wire. The colors must be fast, fadeless and capable of withstanding cleaning in the event that the wire becomes soiled.

6.6 All circuit wires shall be tagged in cabinets with 1/2" diameter 1/16" thick tags securely fastened to conductors, with heavy type of linen wrap at time wires are pulled in and tested. Circuit number shall be stamped into the tags. TAGS SHALL NOT BE REMOVED FOR ANY REASON.

6.7 At least six-inch (6") loops or ends shall be left at each outlet for the installation of devices or fixtures in the future.

PART 7 - OUTLETS, BOXES AND INSTALLATION

7.1 The location of all boxes should be approved by the Engineer prior to roughing-in.

7.2 All boxes shall be Appleton, Steel City, Raco or equal, be stamped, one piece, galvanized steel, be of proper size and shape for conduits entering them, be UL and NEC approved, be installed so that device and/or cover plates shall be tight and plumb with wall finish, have unused openings closed with knock out closures, have all exposed (surface mounted) boxes secured to construction by means of toggle bolts or lead expansion anchors or Ramset, be weatherproof for exterior locations.

7.3 All outlet boxes for recessed fixtures shall be four inch (4") square or octagonal; minimum of 1 1/2" deep; complete with blank cover; installed above fixture opening; connected to fixture with Greenfield of such length to service fixture but not more than 6'0" long, and wire size minimum #14 AWG type TF or AF 300 volt.

7.4 All switch and receptacle boxes shall be four inch (4") square for up to two (2) devices; solid ganged boxes for over two (2) devices; complete with 1" minimum depth tile ring for exposed tile, concrete block or paneled walls complete with 1" minimum depth plaster ring for plaster walls; covered with 1/2" raised galvanized device covers for exposed conduit work; installed so that device covers shall be tight and plumb with wall finish; close to trim when located by doors or windows.

7.5 Bracket outlets shall be level and centered on columns or above doors when installed in these locations. Wall switch outlets at door locations shall be on the lock/latch side of the door.

7.6 All fittings, hangers, fasteners, etc., shall be strong in construction and of such materials as to prevent any chemical reaction between itself and the conduit or device it is fastening or supporting.

7.7 Where indicated on the drawings, and noted in the specifications, outlets on exposed conduit systems shall be of the threaded-hub, cast-metal, conduit type sitting suitable for the wiring devices to be installed. Fittings shall be as manufactured by Appleton Electric, Crouse-Hinds, Killark or equal. Covers (blank, switch, receptacle, etc.) shall be a type designed to fit the specified fittings.

7.8 Proper cast boxes and covers shall be furnished for all exposed outlets. Fittings for exposed work shall be installed and be type and kind as herein specified. On masonry walls, concrete walls or ceilings, exposed outlets shall be fastened with no less than two (2) Paine, Phillips, Ackerman-Johnson or equal, screw anchors and round head machine screws. Under no circumstances shall drilling of cast boxes be allowed. Install vapor-proof gasket on all boxes in exterior or wet locations.

PART 8 - LOCATION OF OUTLETS

8.1 In order that any outlets may come in proper relation to paneling, decorated areas, etc., the Contractor shall familiarize himself with the details of these spaces and shall carefully lay out all outlets so that the equipment or piping of other trades passing under, over, across, or in close proximity to same, will not cause the devices or fixtures at or in these outlets to be inaccessible for use or maintenance. The Contractor MUST consult with the others on the project and procure all details of the various locations so as to make the outlet boxes, panel boards, etc., come in proper relation to the work of all others. He shall be responsible for the exact and proper locations of the various portions of his work, and such work must be entirely satisfactory to the Engineer. Consult Architectural Drawings and Details.

PART 9 - MOUNTING HEIGHTS OF OUTLETS

9.1 The exact height of each switch, receptacle, light fixture outlet, etc., shall be determined on the premises in conferences with the Engineer, Equipment Supplier and Contractor.

9.2 The following is a list of normal mounting heights. Unless otherwise noted on the drawings, specified in other section or directed by the Engineer, these heights shall apply and be held as near as possible to the centerline of all services:

Wall Switches - up 50"
Receptacles - up 10"
Desk Telephone Outlets - up 10"
Wall Telephone Outlets - up 60"
TT Switches - up 50"
Disconnect Switches - up 66"
Clock Outlets - up 84"
Fire Alarm Horns - up 84"
Fire Alarm Break Glass Stations - up 50"
Push-button Stations - up 50"
Wall Mounted Light Fixtures - up 78"

NOTE: "Up" denotes up from finished floor.

PART 10 - PULL BOXES AND JUNCTION BOXES

10.1 Pull boxes and junction boxes shall be installed as required by NEC and in all runs of conduit having more than 100 feet in length or the equivalent of four (4) 90 degree bends; entirely accessible; #16 gauge galvanized steel up to 12"x12"x12" size and #10 gauge over 12"x12"x12" size; complete with covers of same gauge as boxes and secured to the box with screws; be securely mounted to the building structure independent of the conduits connected to them. Pull boxes shall be indicated on the Contractor's shop drawings and record drawings.

PART 11 - WIRE CONNECTIONS AND DEVICES

11.1 Joints in conductors shall be as few as possible. Where joints are necessary, they shall be mechanically strong and well made so that the electrical resistance of a joint shall not exceed that of two (2) feet of the conductor.

11.2 On 600 volt wire #8 and smaller, use Ideal wing nuts, or solder #6 and larger, use "OZ" type PCT insulated parallel connectors; use Scotch #88 tape to an equivalent insulation thickness on all un-insulated splices and apply an insulating coat of paint. Manufacturers recommendations as to sizing, stripping, twisting etc., shall be strictly followed.

11.3 Stranded cables shall be soldered into lugs. Wrapping around binding posts shall not be permitted.

11.4 Connections shall be made with screw-on, set-screw, clamp-on, split-bolt, crimp and compression-type lugs, taps and terminal fittings.

PART 12 - SWITCHES, RECEPTACLES, AND WIRING DEVICES

12.1 Wiring devices, switches, convenience outlets, etc., shall be of quality as manufactured by Arrow and Hart, P & S, Hubbell or equal, UL listed and NEC rated. All receptacles, room switches, etc., shall have finish as approved by the Engineer. Gang plates shall be used for all multiple device locations, in no case shall individual plates be ganged. This shall include telephone.

12.2 All power receptacles shall be of the grounded type as herein specified.

12.3 It shall be the responsibility of the Contractor to verify that the proper patching has been completed around openings and has not damaged any devices. Where damaged or painted devices occur, they shall be replaced or cleaned to the satisfaction of the Engineer at no additional cost to the Owner.

12.4 Where cover plates do not completely conceal the rough openings for the devices, it shall be the responsibility of the Contractor to patch, paint, etc., around the opening to the satisfaction of the Engineer.

12.5 Where more than one (1) device occurs in one outlet box, causing 300 volts or more between them, a barrier must be provided between them to meet NEC 300 volt maximum rule.

12.6 Catalog numbers are for ivory finished devices, but the color of all devices must be compatible with room finished and approved by the Engineer prior to installation.

12.7 All switches shall be quiet type.

12.8 The following is a performance specification for Switches and Receptacles:

SWITCHES:
Single Pole-Hubbell #1121-1, 277-125V-20A
Three-Way Hubbell #1123-1, 277-125V-20A
Four-Way - Hubbell #1124-1, 277-125V-20A

RECEPTACLES:
Single- Hubbell #5251, 125V-15A
Duplex - Hubbell #5242-1, 125V-15A

PART 13 - SWITCH, RECEPTACLE, AND WIRING DEVICE COVER PLATES

13.1 Cover plates shall be specification grade smooth, with metal finish. All plates covering a special device or remote switch whether single or ganged shall be engraved clearly identifying its function.

13.2 Weatherproof locations shall have "FS" boxes with Bell #1930 cover or equal; flush boxes with #1900 cover plate or equal. All receptacles must be corrosion resistant type.

PART 14 - PHOTO-CELLS

14.1 Photo-cells shall be equal or greater than Paragon Multiple Controls, Inc. minimum 3000 watts, 10 amps at 120 volts, Model T 30-0 or 1800 watts Model T-15. Die cast aluminum housing for 3/4" conduit threaded hub nipple. Directional lens,

14.2 For 208 volt circuits use locking type control - 1800 watts.

14.3 All photo-cells shall fail in the "ON" position.

END OF SECTION

APPENDIX 6

Name and Address of the landowner in the proposed certificated area:

Four J Land And Cattle Company
P.O. Box 308
Waynesille, Misosuri 65583