

CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

CITY OF HOUSTON

TO SERVE

CITY HALL ANNEX
STORM WATER PUMP STATION

WALTER P. MOORE AND ASSOCIATES, INC.
1301 McKinney, Suite 1100
Houston, Texas 77010

TABLE OF CONTENTS

<u>Subject</u>	<u>Pages</u>
Division 1 General Requirements	
Section 01090 Reference Specifications and Standards	1
Section 01500 Local Conditions	3
Section 01600 Materials to be Furnished by the Contractor	3
Division 2 Sitework	
Section 02102 Clearing and Grubbing	3
Section 02210 Site Grading	7
Section 02220 Trenching, Backfilling and Compaction	3
Section 02246 Cement Stabilization	7
Section 02401 Trench Safety	7
Section 02485 Hydromulch Seeding	6
Section 02540 Erosion and Sedimentation Control	2
Section 02500 Drainage	5
Section 02532 Stormwater Utility Pumping Stations	8

1.00 GENERAL

1.01 DESCRIPTION

This specification defines the general standards and specifications of materials to be supplied by the Contractor, the method of obtaining approved substitutions to specified products, and proprietary products.

2.00 STANDARD SPECIFICATIONS AND CODES

The materials to be furnished by the contractor which are specified by reference to standard specifications or codes shall be in compliance with the latest editions of revisions thereof in effect on the date bids are received, including any amendments or supplements. In the event of conflicting requirements between a referenced specification, standard, or code, and these specifications, these specifications shall govern.

Unless otherwise specified, all materials that will become a part of the completed work shall be new and shall conform to the specifications and standards referred to herein. In the event that the materials are not covered by the specifications, the materials furnished shall be of standard commercial quality. Where types, grades, or other options offered in the reference specifications are not specified in these specifications, the material furnished will be acceptable if it is in accordance with any one of the types, grades, or options offered.

3.00 SUBSTITUTIONS

The references to materials, wherein manufacturer's products or brands are specified, are made as standards of comparison only as to type, design, character or quality of the article required, and do not necessarily restrict bidders to the manufacturer's products or to the specific brand named. It shall be the responsibility of the contractor to provide all descriptive information, test results, and other evidence as may be necessary to prove the equality of materials or products which he offers as being equal to those referenced. Final acceptance of a product as an approved equal shall be determined by the Owner or his designated representative. No extra compensation will be allowed to the contractor for bids based upon substitutions not approved in writing by the Owner or his representative.

4.00 PROPRIETARY PRODUCTS

In some cases a specified brand name will be a proprietary item based upon the Owner's needs or preferences. In this case no substitutions will be allowed. The Owner may, at his discretion, disallow any proposed substitution.

1.00 INVESTIGATION OF SITE CONDITIONS

Bidders are urged to visit the site of the work and by their own investigations satisfy themselves as to the existing conditions affecting the work to be done under these specifications. If the Bidder chooses not to visit the site or conduct investigations, he will nevertheless be charged with knowledge of conditions which reasonable inspection and investigations would have disclosed.

Bidders are also urged to carefully examine all of the materials and information regarding site conditions made available by the Owner and to obtain their own samples and perform tests on the soil and rock materials to determine unit weights, to evaluate shrinkage and swell factors, and to evaluate other properties which the Bidder believes to be significant in arriving at a proper bid.

Bidders and the Contractor shall assume all responsibility for deductions and conclusions as to the difficulties in performing the work.

2.00 ACCESS TO THE WORK AND HAUL ROUTES

2.01 GENERAL

All work necessary for construction access to, from and within the site shall be performed by the Contractor at his expense unless otherwise identified as a bid item.

The Contractor shall make his own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect transportation and ingress and egress at the jobsite. It shall be the Contractor's responsibility to construct and maintain, at his own expense and at his own risk, any haul roads, access roads, bridges, or drainage structures required for construction operations.

2.02 EXISTING ROADS

The use of existing roads shall be at the Contractor's own expense and risk. It shall be the contractor's responsibility to anticipate and meet all conditions properly imposed upon the use of existing roads by those having jurisdiction thereover, including (without limitation of the generality of the foregoing) seasonal or other limitations or restrictions, the payment of excess size and weight fees, and the posting of bonds conditioned upon repair of road damage caused by contract-generated traffic. It shall be the Contractor's responsibility to satisfy all lawful demands for repair of damage to existing roads caused by contract-generated traffic.

2.03 HAUL ROUTES

The hauling of sand, gravel, earth materials, or other hauling over public highways, roads, or bridges shall be in compliance with applicable local regulations and shall be such as to minimize interference with, or congestion of, local traffic.

The contract shall use only the on-site haul routes shown on the plans or designated by the Owner. In no case shall the Contractor construct roads outside the limits of the

cleared areas unless approval is obtained from the Owner. The Contractor shall exercise care to preserve the natural landscape.

3.00 USE OF LAND FOR CONSTRUCTION PURPOSES

The Contractor will be permitted to use land controlled by the Owner for field offices, storage yards, and other facilities required for construction operations.

The location, construction, maintenance, operation, and removal of the Contractor's construction facilities shall be subject to the approval of the Owner.

4.00 EXISTING UTILITIES

4.01 GENERAL

An effort has been made to identify on the plans all existing utility lines within the area of the proposed work. However, this does not relieve the Contractor from the responsibility and liability of locating accurately all utility lines affecting the Contractor's work, whether shown or not, and taking such steps as necessary to protect those existing lines in place. The Contractor shall be responsible prior to construction for contacting the utility coordinating committee and/or the local utility companies to verify line existence and location. If an uncharted utility line is encountered during construction, the Contractor shall contact the Owner and the affected utility company immediately and await instructions before proceeding with that portion of the work. Failure to report the incident promptly will result in the Contractor bearing full responsibility for all resulting damages.

4.02 CONTRACTORS USE OF EXISTING UTILITIES

Unless the Contractor makes prior arrangements with the Owner, the Contractor will be responsible for acquiring the necessary permits and approvals for any temporary services that may be required by the Contractor during construction. Without written approvals from the Owner, the Contractor's use of private utilities or public utilities from the Owner's private services lines is prohibited. Use of the Owner's existing services without permission from the Owner shall result in a decrease in the contract amount equal to the cost of those services, including the Owner's handling costs.

4.03 CONTRACTOR'S TEMPORARY SERVICE LINES

Where the Contractor uses temporary services of utilities which result in temporary installation of service lines, those lines shall be the total responsibility of the Contractor. All costs associated with those services shall be considered as incidental to the work. All temporary lines must be completely removed and the affected area restored at the completion of the project unless specifically directed otherwise by the Owner.

5.00 EXISTING FENCES

5.01 GENERAL

Fences within the construction limits shall be removed by the contractor where necessary for the performance of work and, where required, shall be rebuilt in at least as good condition as found. All fence removal must be approved by the Owner prior to removal.

6.00 LAYOUT CONTROL

6.01 GENERAL

Layout of the project limits shall be the responsibility of the contractor and contractor shall conform to the limits as depicted on the drawings.

7.00 APPROVALS

Wherever in these specifications approvals are required, that approval shall come from the Owner, the Owner's Agent, or the Owner's designated representative. There may be more than one specified representative designated for approvals depending upon expertise and their role in the project. It shall be the Contractor's responsibility to determine the proper approving agent and to seek and acquire that approval in a timely manner prior to proceeding with the phase of work.

8.00 SITE SAFETY

The Contractor is responsible for keeping the project site and all his operations in regard to this project within all applicable Federal, State and local safety standards. Where specific safety standards are specified within the contract documents, including the plans, these specifications and any supplements, addenda, or other attachments thereto; these specific standards are meant to call the attention of the specific safety standards applicable to this project, but do not remove any responsibility of the Contractor to meet all applicable safety standards.

1.00 GENERAL

The Contractor shall furnish all materials required for completion of this work.

Materials furnished by the Contractor shall be of the type and quality described in these specifications. The Contractor shall make diligent effort to procure the specified materials from any and all sources, but, if material required by the specifications become unavailable, substitute materials may be used: Provided, that no substitute materials shall be used without prior written approval of the Owner, said written approval to state the amount of the adjustments, if any, to be made in favor of the Owner. Based upon the Owner's determination as to whether a substitution shall be permitted, and as to what substitute materials approved are of less value to the Owner, or involve less cost to the Contractor than the materials specified, an adjustment shall be made in favor of the Owner. Where the amount involved or the importance of the substitution is warranted, an order for changes will be issued. The adjustments not handled by a Change Order will be handled by deduction from payments to the contractor on the basis of prices stated in the written approval. No payments in excess of prices bid in the schedule will be made because of substitution of one material for another, or because of the use of one alternate material in place of another.

2.00 TESTING AND INSPECTION OF MATERIAL

Materials and equipment furnished by the Contractor which will become a part of the completed construction work shall be subject to testing and inspection at any one or more of the following locations: at the place of production or manufacture, at the shipping point, or at the site of the work. To allow sufficient time to provide for inspection and testing, the Contractor shall submit to the Owner, at the time of issuance, copies in triplicate of purchase orders, including drawings and other pertinent information, covering materials and equipment on which testing and/or inspection will be made as advised by the Owner, or shall submit other evidence in the event such purchase orders are issued verbally or by letter.

The testing and inspection of materials and equipment at any of the locations specified above or the waiving of the testing and/or inspection thereof shall not be construed as being conclusive as to whether the materials and equipment conform to the contract requirements, nor shall the Contractor be relieved thereby of the responsibility for furnishing materials and equipment meeting the requirements of these specifications. Acceptance of all materials and equipment will be made only at the site of the work.

Testing and inspection shall be carried out and paid for as defined in the Supplementary Conditions.

3.00 SCHEDULES

The Contractor shall provide to the Owner for approval within fourteen (14) days after the official notification to proceed a detailed Critical Path Method (CPM) Schedule identifying all important construction phases and prerequisite portions of work to show how the Contractor intends to complete the project within the allotted time for construction. Included within the schedule shall be a shop drawing submittal schedule identifying when each shop drawing will be submitted and the latest date of return,

assuming one resubmittal, that will not require a delay in schedule (allow at least ten (10) working days for review). Those items in which the turnaround for approvals are extremely critical to the schedule should be identified. The schedule shall be clear and concise such that progress can be monitored from the items identified on the schedule. When, from time to time, changes occur which substantially alter the schedule, the Owner may request a schedule update to reflect the approved schedule changes. Although it is requested that actual dates be used to define start and completion of the various identified portions of work, the Contractor will not be held accountable for meeting any dates not specifically defined in the General Agreement and Supplementary Conditions.

4.00 SUBMITTALS

Where specifically called for in these specifications or on the plans, shop drawings and/or other submittals shall be provided for approvals. A minimum of five (5) complete copies of the submittals must be submitted. The Contractor shall present a shop drawing and submittal schedule to the Owner within fourteen (14) days following the notice to proceed which identifies approximately when each shop drawing or submittal will be submitted and when the drawing must be returned in order to allow for the project schedule to be met. The Contractor should allow for at least ten (10) working days for review of shop drawings and submittals. If a shop drawing or submittal has been rejected, review of all subsequent submittals of that shop drawing or submittal which are rejected shall be at the expense of the Contractor, the cost of which shall be reduced from the contract amount.

5.00 PROGRESS REPORTS

At the end of each billing period, a progress report shall be submitted by the Contractor with the payment request. This progress report shall address at a minimum the schedule items completed, when completed, the items to be started during the next billing period, the items expected to be completed during the next billing period, the percent complete of all ongoing items, key issues which need to be resolved, any necessary adjustments in the schedule and why, and a report of any accidents on the job. This report will be a part of the payment request and will be necessary to process the payment request.

6.00 PROJECT RECORD DOCUMENTS

Upon completion and final acceptance of the work and before final payment is made, the Contractor shall provide to the Owner one set of Project Record Documents plans provided by the Owner clearly marking all deviations and changes to the project which are not reflected on the plans. The Owner will provide an unmarked set of reproducible drawings of the plans and one set of the other contract documents as necessary for the Contractor for the preparation of the Record Documents. These drawings shall include such items as changes in location, elevation, material, dimensions, sizes, product make or manufacturer, material or equipment specification, and other such items as deemed significant to record the actual conditions of the completed project. Final payment shall not be made until these documents have been reviewed and approved by the Owner.

PART 1 GENERAL

Subsurface data is available from the Owner Engineer Architect etc. Contractor is urged to carefully analyze the site conditions.

1.01 SCOPE

This section pertains to the specifications for clearing and grubbing, topsoil removal and stockpiling, and disposal of all vegetation, rubbish and excess material, as required for fill placement and related staging areas as noted on the drawings and in accordance with these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 01500 Local Conditions
2. Section 01532 Preservation of Trees and Shrubbery
3. Section 02210 Site Grading
4. Section 02540 Erosion and Sedimentation Control

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

A. Construction

That portion of the site required for constructing the work under these specifications shall be cleared of all vegetation, such as trees, brush, grass and weeds and all other objectionable matter to the limits as depicted in the plans. Stumps and roots shall be removed to a depth of two (2) feet below existing or proposed grade, whichever is lower.

B. Staging Areas

Clearing for the staging areas if required shall be performed as provided in paragraph A above for construction areas except that trees designated by the Owner to remain shall not be cut, and shall be protected from injury. Approval must be obtained from the Owner to use any area for staging that is not specifically identified as such on the plans. The Contractor shall restore all areas used for staging, the extent of said restoration to be defined by the Owner upon granting approval for the use of said area for staging.

3.02 STRIPPING

- A. After the area has been cleared of all vegetation and rubbish, the top six (6) inches of soil shall be stripped. Any soft spots or pockets of organic matter exposed during stripping shall also be removed as required to meet specifications. All stripped topsoil material shall be stockpiled according to this section. Proof roll the site to identify potential pumping areas or soft areas and notify the Engineer of the conditions before continuing the work.
- B. At all times during earthwork operations the area shall be kept in a manner to prevent ponding. Erosion and sedimentation protection shall be provided in accordance with Section 02540 "Erosion and Sedimentation Control."

3.03 DISPOSAL

A. DISPOSAL OF CLEARED MATERIALS

Subject to approval of the Owner, material from clearing operations shall be disposed of by burning and/or removal from the worksite.

1. Disposal of Materials by Burning

Disposal of materials by burning will not be allowed.

2. Disposal of Material by Removal

Material disposed of by removal from the construction area shall be removed from the areas prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.

Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the Contractor.

In hauling any material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site or area streets and roads. The Contractor shall promptly remove any debris which falls from vehicles.

3.04 STOCKPILING

All topsoil from the stripping operations shall be stockpiled in the areas so designated on the drawings. Materials shall be deposited and spread in such a manner to ensure proper drainage and prevent severe erosion of the stockpile.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section pertains to the grading of the site as required for construction of pavement surfaces and drainage as shown on the drawings and in accordance with these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 01500 Local Conditions
2. Section 01600 Materials to be Furnished by the Contractor
3. Section 02102 Clearing and Grubbing
4. Section 02220 Trenching, Backfilling and Compaction
5. Section 02540 Erosion and Sedimentation Control

1.03 PERMITS

Prior to commencement of work, the Contractor shall be responsible for obtaining, at his own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 APPLICABLE PUBLICATIONS

The following specifications of the latest issue listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent required by the references thereto.

- A. Texas Department of Transportation 1993 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT).
- B. American Society for Testing and Materials (ASTM).
 1. D 698 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. Rammer and 12-inch Drop.
 2. D 1556 Density of Soil in Place by the Sand-Cone Method.
 3. D 4253 Maximum Index Density of Soils using a Vibratory Table.
 4. D 4254 Minimum Index Density of Soils in Calculation of Relative Density.

1.05 PROTECTION OF EXISTING UTILITIES AND ADJACENT WORK

- A. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. When working near public and private utility company lines Contractor shall contact the local utility coordinating committee or the utility company involved to locate their lines.
- B. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.
- C. If it is ascertained by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed.
- D. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and damage is caused to said utilities, Contractor shall repair, at his own expense, such damage to the satisfaction of the Owner and the Utility Company.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

Fill materials and sources must be approved by the Owner. The Contractor is responsible for providing adequate samples and testing results to the Owner for testing and approval. Select fill shall be used beneath all structures and pavements where fill material is required to achieve the grades and elevations on the plans.

2.01 SELECT FILL

The select fill shall consist of sandy clay, lime stabilized clays or clean sand, uniformly graded and free of objectionable material.

- A. Sandy Clay Fill: Sandy clay fill shall have a plasticity index between 10 and 20. The fill materials shall be placed in loose lifts not exceeding eight (8) inches in height and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as defined by ASTM D 698.
- B. Lime Stabilized Clay Fill: Lime clays may be stabilized in place or mixed with lime at another location on the site and placed and compacted. Lime stabilization shall be performed in accordance with Section 02240 "Lime Stabilization". The percent of lime to be used shall be determined by the testing laboratory at the source prior to acceptance of the material for fill. The material shall be placed in loose lifts not exceeding eight (8) inches in thickness and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as determined by ASTM D 698.

2.02 GENERAL FILL

General fill material shall be used for fill in landscaping areas not supporting structures or pavement. General fill material may be any native soil free of debris, trash, rocks over 2 inches in diameter and other objectionable material. General fill shall be placed and compacted in lifts not exceeding 12" in thickness to 95 percent standard density as

defined by ASTM D 698. Where called for by the plans or by the landscape specifications, the fill shall be kept sufficiently low to accommodate the proper depth of topsoil.

2.03 TOPSOIL

Topsoil material shall be native earthen material suitable for growth of vegetation such as silty and sandy loams. The site stripings may be used as topsoil unless otherwise dictated by the Owner. Topsoil shall be spread over landscape areas to a depth of 4 to 6 inches and compacted to 85 percent of standard density ASTM D 698.

PART 3 EXECUTION

3.01 EXCAVATION

A. General

Contractor shall complete all excavation required regardless of the variations in hardness, type, or density of materials encountered, to the dimensions and elevations shown on the drawings. When unsatisfactory material is uncovered, that material shall be removed and replaced with structural fill, the extent of such excavation to be directed by the Owner. Unsatisfactory material shall be removed to the stockpile area or from the site as directed by the Owner.

B. Excavation for Pavement

1. The material exposed after excavation shall be scarified to a depth of six (6) inches and compacted to at least 95 percent of Standard (ASTM D 698) Maximum Density within 2 percent of optimum moisture content of the soil. Where necessary to achieve the required compaction, stabilization methods shall be used.
2. Excavation required beneath pavement sections shall comply with elevations and dimensions shown on the plans and detailed sections within a tolerance of plus or minus 0.10 foot. Contractor shall take care not to disturb areas that are designated to be protected or are outside the construction limits. Excavated areas shall be kept free of ground and surface water.

C. Cut Slopes and Ditches

Slopes and grades of ditches shall conform to the plans within a tolerance of plus or minus 0.10 foot. No exposed slopes shall be steeper than three feet horizontal to one foot vertical. Where slope protection is specified or called out on the plans, said protection shall be placed as soon as practical, after exposing the slope. Erosion and sedimentation controls shall be implemented in all cut areas as specified in Section 02540, Erosion and Sedimentation Control.

3.02 FILL AND BACKFILL

A. Placement

1. Fill material shall be placed in loose lifts not exceeding eight (8) inches for areas beneath buildings and pavement and twelve (12) inches for landscape areas not supporting structures. Fill areas shall be compacted to 95 percent of Standard Maximum Density at the proper moisture of that soil as defined by ASTM D 698.
2. Each lift shall be thoroughly compacted and shall have obtained satisfactory density prior to proceeding with the next lift.
3. The top six (6) inches shall be stabilized after placement as directed by Owner.
4. Material shall be free of trash and rocks over three (3) inches in diameter.
5. Fill shall be brought up to the proper elevations as determined from the lines, grades, sections and elevations shown on the plans.

B. Compaction and Finishing

1. Suitable compaction equipment such as a sheepsfoot roller should be used.
2. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The surface grade shall be consistent with the drainage intent shown on the plans such that no ponding shall occur.
3. Surface shall not be more than 0.10 feet above or below the established grade, and all ground surfaces shall vary uniformly between indicated grades.
4. Cut material from the site may be used for fill material if approved by Owner. Where cut material is used as fill, each lift of such material shall be properly mixed to obtain a uniform material, with clay the predominant material when mixed with silt, and a plasticity index less than 20.

3.03 EROSION PROTECTION

- A. There shall be at all times adequate protection to newly graded areas to prevent soil erosion as provided in Section 02540, Erosion and Sedimentation Control.
- B. Soil erosion that occurs prior to acceptance of the work shall be repaired at no expense to the Owner.

3.04 GRADING

A. Rough Grading

1. Cut and fill shall be left sufficiently high to require cutting by fine grading.
2. Grade to subgrade depths required for construction of finished surface materials and for controlled internal drainage of site.

B. Fine Grading

Fine grading shall conform to elevations required to insure finished elevations as indicated on the drawings.

3.05 TESTING AND INSPECTION

A. Testing of Materials and Installed Work

Materials and installed work require testing to show that the specifications for the materials and work have been met. The Owner may, at his expense, take random tests on materials and installed work. The Contractor shall allow free access to material stockpiles and facilities at all times. In fill areas each lift must be tested and approved before proceeding on the next lift. Tests, not specifically indicated to be done at Owner's expense including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

1. Testing to be provided by Contractor
 - a. All retesting for areas failing the first test.
 - b. Concrete Strength
 - c. Soil densities
 - d. Pipe leakage
- B. Contractor shall notify Owner 24 hours prior to performing any testing. (or) Contractor shall notify Owner's testing laboratory 24 hours in advance of beginning any earth work operations and coordinate testing schedules to meet these specifications.
- C. Maximum density tests per ASTM D 698 shall be taken on all fill materials at a rate of one test for each type of soil to be used and at least one test for every 1000 cubic yards of fill.
- D. Field density tests per ASTM D 1556 or ASTM D 2922 shall be taken on all fill material at a rate of one test for every 10,000 square feet and at least one test per lift.
- E. All imported fill material shall be approved prior to importing.

3.06 DUST ABATEMENT

- A. The Contractor shall comply with applicable Federal, State, and local laws and regulations concerning the prevention and control of dust pollution.
- B. During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the Owner or elsewhere, the Contractor shall furnish all the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging adjacent properties, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from his operations under these specifications.
- C. The cost of sprinkling or of other methods of reducing formation of dust shall be included in the prices bid in the schedule for other items of work.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

This Section specifies the requirements for excavating and backfilling for storm sewer, sanitary sewer, water distribution lines, and all related appurtenances. Excavation and backfill shall be in conformance with the locations, lines, elevations and grades shown on the plans.

1.02 APPLICABLE PUBLICATIONS

The following specifications and standards of the latest issue listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent required by the reference thereto.

American Society for Testing and Materials (ASTM).

- a. D 698 - Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 Pound Rammer and 12 Inch Drop.
- b. D 1556 Density of Soil in Place by the Sand-Cone Method.
- c. D 4253 - Maximum Index Density of Soils using a Vibratory Table.
- d. D 4254 - Minimum Index of Soils in Calculation of Relative Density.

1.03 RELATED WORK SPECIFIED ELSEWHERE

1. Section 01500 - Local Conditions
2. Section 01600 - Materials to be Furnished by the Contractor
3. Section 02401 - Trench Safety

PART 2 PRODUCTS

A. Earth Backfill

Earth backfill shall be native soils free of debris, trash, rocks over 2 inches in diameter and other objectionable material.

B. Cement Stabilized Sand Backfill

Cement stabilized sand material shall be a clean bank sand meeting TxDOT Test Method TEX-110-E, Type A and shall be mixed thoroughly with 1-1/2 sacks of Portland Cement per cubic yard of sand material.

C. Sand Backfill

Clean bank sand meeting TxDOT Test Method TEX-110-E, Type A.

PART 3 EXECUTION

3.01 EXCAVATION

A. General:

1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five (5) feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be removed from the trench sufficiently prior to the line placing operation to insure a dry, firm bed on which to place the utility line.

B. Sewer Trenches:

1. For pipe sizes less than 42" in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
2. For pipe sizes 42" in diameter and larger the minimum trench width shall be outside diameter of pipe plus 24 inches.
3. Trenches shall be excavated to a depth at least 6" below the barrel of pipe, then the pipe bedding shall be placed as shown on the appropriate details contained with the plans and as described in paragraph 3.02 A. of this section.

C. Appurtenances

1. Excavation for manholes, tie-in to existing facilities and similar structures shall be sufficient to leave at least 12" in the clear between the outer surfaces and the embankment or sheet piling that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances shall be refilled with cement stabilized sand, as directed, at no additional cost to Owner.

3.02 PIPE BEDDING AND BACKFILL

A. Storm sewer trenches:

1. Pipe shall be bedded in trench in accordance with the details shown on the plans. When pipe has greater than twelve (12) feet of cover, use Class A bedding and backfill.
2. Cement stabilized sand shall be composed of clean, local sand and not less than 1-1/2 sacks of Portland cement per cubic yard of mixture, mixed in a mill type mixer. When the details call for cement stabilized

sand bedding, the material shall extend from a point 6" below the bottom of the pipe to the level of the spring line. This material cannot be used after it loses its moisture content.

3. The cement stabilized sand shall be thoroughly rodded after being placed in trench.
4. Bedding, sewer pipe and initial backfill over the top of pipe must be placed in a single day's operation for any given portion of pipe. Initial backfill shall be placed to one foot above the top of pipe for earth backfill and 6 inches over the top of pipe for cement stabilized sand backfill.
5. Remainder of trench backfill shall be placed the next day or later in 8" lifts, after pipe is laid in conformance with these specifications and the details on the plans.
6. Backfill shall be placed in uniform layers not to exceed 8" loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D 698) at the proper moisture content specified in the soils report for this project.
7. Backfill, under pavement and to one foot from outer edge, shall be cement stabilized sand of the type and method described under paragraph 3.02 A.1 through 5, above, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 3.02 A.5. above and stabilized where required.

END OF SECTION

PART 1 GENERAL

This Section is intended to provide specifications for the minimum requirements for trench safety. The Contractor shall endeavor to insure the safety of his employees working in and around trenches and other excavations in accordance with current OSHA standards and in particular, C.F.R. part 1926, latest amendment thereto. These specifications outline minimum standards of construction safety to be followed, but should not be construed as the means, methods and operations of construction. Where the Contractor deviates from these outlined minimum standards, the Contractor is required to submit for approval by the Owner sealed engineering plans designed by a Registered Professional Engineer in the State of Texas showing the proposed method of trench protection. A copy of the approved design shall be kept at the site.

1.01 SCOPE

For all trenches in excess of five (5) feet of depth or for all trenches less than five (5) feet of depth in soils which will not stand up in vertical excavations, the Contractor shall either lay back the sides of the excavation, provide sheeting and shoring to hold the walls of the excavation in place, or use a trenching box meeting or exceeding the protection provided by the sheeting and shoring system. In all cases the method of trench wall protection shall be in conformance with the plans, details, and specifications or an Owner approved method designed and sealed by a Registered Professional Engineer. Owner's approval shall be permission to deviate from the specifications only and shall not be construed in any way to mean approval of the specific design, means or method of construction. The Contractor shall assume full responsibility for the system design he uses, including those options presented in the contract documents and in these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02210 - Site Grading
- B. Section 02220 - Trenching, Backfilling and Compaction

PART 2 PRODUCTS

Materials used for sheeting, sheet piling, cribbing, bracing, shoring, underpinning, and other structural retaining systems shall be in good serviceable condition, of good quality, of a suitable condition and grade to perform the intended use. Wood shall be sound, free from large or loose knots, and of the proper dimensions. The Contractor shall be responsible for maintaining the systems in a manner consistent with the intended design and in a manner that will prevent exposure of works to hazards.

PART 3 EXECUTION

3.01 GENERAL SAFETY REQUIREMENTS

- A. The work area shall be kept free of hazards to the employees. All surface encumbrances which may create a hazard shall be removed, supported or otherwise isolated as necessary to safeguard employees.

- B. The Contractor shall take special precautions to locate existing utilities and to protect those systems as required. The Contractor shall call the Utility Coordinating Committee as required 24 hours prior to excavating around existing utilities.
- C. The Contractor shall provide safe access and egress to excavations. Ramps or stairways shall be structurally sound and capable of providing a safe means of escape from the excavation. Trenches in excess of four (4) feet in depth shall have a safe means of egress from the trench spaced such that no more than 25 feet of lateral travel would be required to reach the egress system.
- D. The employees shall be protected from work place hazards such as vehicular traffic, falling loads, and hazardous atmosphere. Excavations shall be marked so that employees and equipment are clearly warned of the location of the excavations. Trenches shall be kept free of water accumulation such that it would present a hazard to employees. Adjacent structures shall be stabilized as necessary so as not to present a possible hazard to the employees. Equipment shall be kept sufficiently clear of excavations so as not to create a potential overburden stress to trench walls causing cave-ins. Safe access shall be provided with handrails where access over trenches is required.
- E. Emergency rescue equipment as required by OSHA shall be readily available at the site and shall be maintained to good working condition.
- F. Daily inspections of excavations, the adjacent areas, and the protective systems shall be made by a person or persons competent to make such inspections to keep the Contractor notified of unsafe conditions so that necessary precautionary action can be taken.

3.02 TRENCH WALL LAYBACK

A. GENERAL

In areas where no pavement or other structural elements are to be constructed, the sides of the trenches over five (5) feet deep may be sloped to provide protection from cave ins. If written approval is given by the Owner, trenches beneath pavement or other structures may also be laid back. Backfill for laid back trenches shall be as provided for a vertical wall trench for the full width of the excavation.

B. LAYBACK SLOPE REQUIREMENTS

1. The Contractor shall be responsible for providing the proper lay back slopes for all soil conditions encountered. Where soils data is provided for the Contractor's use, that information is intended as a sampling of the types of soils materials that may be encountered; however, the Contractor shall be diligent in observing the actual soil conditions as his work proceeds and shall be responsible for providing a safety system adequate to meet the minimum standards for the actual types of soils encountered. Special precautions shall be taken to monitor conditions when working in fill areas, areas subject to surcharge and areas exposed to vibrations from nearby equipment and machinery.

2. At the Contractors option where a layback trench system is approved for use, the Contractor may layback the sides of the trench at a slope of one and one-half (1 1/2) feet horizontal to one (1) foot vertical without testing for the soils stability. When this method is used, it does not preclude the removal of unsuitable materials encountered and replacement with suitable materials. This method shall not be used in unsuitable soils such as wet sands, silts, peat or in other areas which require special procedures, equipment and materials.
3. The Contractor may engage a competent person in the means of soil classification to determine the soil classification as a means of reducing the trench wall slopes. Layback slopes may be sloped up to the maximum allowable slopes as follows for the given types of soil.

MAXIMUM ALLOWABLE SLOPES

<u>Soil Materials</u>	For Excavations Less than 20 <u>Feet Deep [3]</u> Slope H:V	
Stable Rock	Vertical	(90°)
Type A-[2]	3/4:1	(53°)
Type B	1:1	(45°)
Type C	1 1/2:1	(34°)

Notes:

- a) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
 - b) A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
 - c) Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.
4. The types of soil given in paragraph 4.02 C are defined as follows:
 - a) Stable Rock - Natural solid mineral matter that can be excavated with vertical sides and remain in tract while exposed.
 - b) Type A - Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam cemented soils such a caliche and hard pan are also considered Type A. However, no soil is Type A if:
 - i. The soil is fissured.
 - ii. The soil is subject to vibration from heavy traffic, piling driving, or similar effects.
 - iii. The soil has been previously disturbed.

- iv. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.
 - v. The soil is subject to other factors that would require it to be classified as a less stable material.
- c) Type B - Soil that meets one of the following:
- i. Cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot, but less than 1.5 tons per square foot.
 - ii. Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam and in some cases, silty clay loam and sandy clay loam.
 - iii. Previously disturbed soils except those which would otherwise be classified as Type C soil.
 - iv. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration.
 - v. Dry rock that is not stable.
 - vi. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical, but only if the soil would otherwise be classified as Type B.
- d) Type C - Soil that meets one of the following:
- i. Cohesive soil with an unconfined compressive strength of 0.5 tons per square foot or less.
 - ii. Granular soils including: gravel, sand and loamy sand.
 - iii. Saturated or submerged soil.
 - iv. Submerged rock that is not stable.
 - v. Soil in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.
5. Unconfined compressible strength shall mean the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, estimated in the field using a pocket penetrometer, or other previously approved method.
6. Wet soil shall mean soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.
7. Layered systems shall be classified in accordance with its weakest layer; however, each layer may be classified individually where a more stable layer lies under a less stable layer.
8. Previously classified material whose properties, factors, or conditions affecting its classification change in any way shall be reclassified as necessary as changes to the trench shall be accomplished before

continuing any work in or near the trench where there may be potential danger to workers due to trench failure.

9. The slope of a laid back trench wall shall be less steep than the maximum allowable slope when there are signs of distress. The maximum allowable slope for a material in distress shall be 1/2 horizontal to one vertical less steep than the maximum allowable slope for the material in a non-distressed condition. Distress shall mean a condition in which a cave-in is imminent or likely to occur.
10. When surcharge loads from adjacent structures, stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such a reduction is achieved.
11. An adequate means of exit such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel.

3.03 TIMBER SHORING

A. GENERAL

Timber shoring may be used as a means of trench protection from cave-ins in trenches that do not exceed 20 feet in depth. The timber shoring system may be used in lieu of sloping and benching systems, or in conjunction with those systems. Good judgement shall be used by the Contractor in selecting the proper system when alternative design are given.

B. SOIL CLASSIFICATION

The timber shoring systems designs are subject to soil classifications outlined in 3.02-D of this section. Classification shall be conducted by a competent person using the proper means and methods of classification described in this section.

C. BASIS AND LIMITATIONS

1. Dimension of Timber Members

- a) The sizes of the timber members shown in the details are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition where NBS did not recommend specific sizes for members, member sizes are based upon an analysis of the sizes required for use by existing codes and an empirical practice.
- b) The required dimensions of the members listed in the tables refer to actual dimensions and not nominal dimensions of the timber.

2. Limitation of Application

- a) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to situations that are anticipated to be present at the site. Where the system provided does not meet the requirement of the actual conditions in the field, the Contractor shall either notify the Owner of the situation and present an engineered solution designed and sealed by the Registered Professional Engineer, or shall notify the Owner of the unanticipated conditions and await instructions.
- b) When any of the following conditions are present, the members specified and shown in the details are not considered adequate.
 - i. When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two foot soil surcharge. Adjacent shall mean the area within a horizontal distance from the edge of the trench equal to the depth of the trench.
 - ii. When vertical loads imposed on crossbraces exceed a 240 pound gravity load distributed on a one foot section of the center of the crossbrace.
 - iii. When surcharge loads are present from equipment weighing in excess of 20,000 pounds.
 - iv. When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless:
 - (1) The sloped portion is sloped at an angle less steep than 3H:1V;
 - (2) The members are selected from the tables based upon the total trench depth from the top of the overall trench and not the toe of the slope.
3. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling or kickouts.
4. Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.
5. An adequate means of exit shall be provided such as a ladder or steps and shall be located so as to require no more than 25 feet of lateral travel.
6. Where necessary due to wet soils or other similar conditions, the shoring system shall use tight sheeting such that material is contained behind the sheeting.

3.04 ALTERNATIVE SHORING SYSTEMS

A. GENERAL

Alternative shoring systems may be used when approved by the Owner. Steel, aluminum or other approved materials may be used in lieu of wood for shoring where the system is designed, constructed and maintained in a manner that will give equal to or greater protection than the wood system.

B. SHEET PILING

Sheet piling may be used when approved by the Owner to shore the sides of the trench. Sheet piles shall be removed at the completion of the work unless otherwise directed by the Owner. When piling is to remain, the piling shall be cut off at least three feet from the top of the excavation. The sheet piling system shall be designed by a Registered Professional Engineer and shall provide equal or greater protection than the specified wood shoring system. Materials for the piling shall be approved by the Owner.

C. TRENCH BOXES

Trench boxes that provide equal or greater protection as the specified wood shoring system may be used. The Contractor shall be responsible for insuring the adequacy, maintenance, and design of the trench box used. The Contractor shall also be responsible for the proper use and operation of the trench box.

D. SHIELD SYSTEMS

1. General

- a) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.
- b) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
- c) Workers shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
- d) Workers shall not be allowed in shields when shields are being installed, removed, or relocated.

2. Excavations of earth material to a level not greater than two feet below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible cave-in below the bottom of the shield.

3. Use of shields shall be subject to approval by the Owner.

END OF SECTION

1.00 GENERAL

1.01 SCOPE

A. Refer to the Drawings, Schedules and Details for type and locations of work required herein. Furnish all labor, materials, equipment and supervision for the installation of items included within these specifications. Such work includes, but is not limited to the following:

1. Furnishing and applying hydromulch seeding including all materials and equipment required for the specified method of lawn installation.
2. Site clean up.
3. Maintenance and guarantee.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specifications to the extent indicated by references thereto:

1. Texas Department of Transportation 1993 Standard Specifications for construction of Highways, Street and Bridges (TxDOT).
 - a. Item 162 - Sodding for Erosion Control
 - b. Item 164 - Seeding for Erosion Control

1.03 RELATED WORK UNDER SEPARATE CONTRACT

A. Section 02210 - Site Grading.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.
2. Certificates of inspection required by law for transportation shall accompany invoice for each shipment of seed or plants. File copies of certificates with Engineer after acceptance of material.

B. Source - Quality Control

1. Seed: The Engineer shall be furnished a signed copy of statement from vendor, certifying that each container of seed delivered is labeled in accordance with the

Federal Seed Act and is at least equal to requirements previously specified. Seed analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be resampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Engineer. If these tests reveal the seed to be below the specified pure live seed content, the Contractor shall be required to plant additional seed to compensate for the deficiency at no additional cost to the Owner. The seed retests will be conducted by the State Seed Laboratory. Allowance will be made for the actual pure live seed content of the specified grasses in determining the actual planting rate.

1.05 SUBMITTALS

- A. Furnish copies of manufacturers literature, certifications, or laboratory analytical data for the following items:
 - 1. Fibre Mulch.
 - 2. Tank Mix Fertilizer.
 - 3. Top Dress Fertilizer.
- B. All submittal data shall be forwarded in a single package to the Engineer with fourteen (14) days of award of the contract.
- C. Samples:

The Owner reserves the right to request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of replacement of materials not meeting the specifications shall be paid by Contractor.

1.06 SCHEDULE

- A. Submit a proposed work schedule to the Owner for approval at least fifteen (15) days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by the Owner.
- B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.
- B. Submit written requests for inspections to the Engineer at least seven (7) days prior to anticipated inspection date.

1.08 MAINTENANCE BY THE CONTRACTOR

- A. The Contractor shall begin maintenance after each plant is installed and continue until Final Acceptance.

- B. The Contractor's Maintenance Period shall begin upon inspection and approval at Substantial Completion and shall be for the period of 60 days.
- C. The Contractor's maintenance of new planting shall consist of watering, weeding, repair of all erosion and reseeding and resodding as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydromulch planting under this Contractor to the effect that a minimum of ninety five (95%) percent of the area planted will be covered with specified planting after sixty (60) days with no bare spots greater than ten (10) square feet. Any sod panels that are dead or dying shall be replaced.
- D. The Contractor shall be responsible for one (1) mowing in the event that the time between seeding or sodding and Final Acceptance exceeds thirty (30) days.
- E. Contractor shall make a second application of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Engineer. Such replanting to be performed within sixty (60) days of initial application and immediately upon notification by Engineer to replant.
- F. Apply top dress fertilizer (16-6-8) at the rate of ten (10) pounds per 1,000 square feet at twenty five (25) days after seeding.
- G. Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, etc., during Guarantee Period. Report such conditions to Engineer in writing.
- H. Contractor shall be responsible for seeding all areas one time only. If small localized areas fail to grow, the Contractor shall reseed. The Contractor will not be required to reseed the entire area if hydromulch is per specifications and properly installed and still fails to grow.

1.10 FINAL ACCEPTANCE: Work under this Section will be accepted by Engineer upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

For Seed: Ninety Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.

The Engineer and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

1.11 CLEAN UP: Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations. Clean up and removal all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Engineer.

2.00 MATERIALS

2.01 SEED: All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Engineer. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage by

weight or pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

<u>Kind of Seed</u>	<u>Minimum % Pure Live Seed Required</u>	<u>Pounds Pure Live Seed Required Per Acre</u>
Bermuda Grass	85	7
K.R. Bluestem	85	1
Bahiagrass (Pensacola)	85	9

Note: $\% \text{ Pure Live Seed} = \% \text{ Purity} \times \% \text{ Germination}$

Weed seed shall not exceed ten (10%) of weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.

2.02 FERTILIZER FOR TANK MIX: Shall be 13-13-13 grade, pelleted, uniform on composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warrant of the producer.

2.03 WOOD CELLULOSE FIBER MULCH: Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination of growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that meets all of the foregoing requirements.

2.04 WATER: Shall be free from oil, acid, alkali, salt, and other substances harmful to growth of grass. The water shall be subject to approval prior to use.

2.05 SLURRY MIX COMPONENTS PER ACRE

Wood Cellulose Fiber Mulch	2,000 pounds
Grass Seed.....	(as specified)
Fertilizer (13-13-13).....	800 pounds

2.06 TOP DRESS FERTILIZER: (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:

16% Nitrogen
6% Phosphoric Acid
8% Potash

3.00 EXECUTION

2.01 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

- A. Bed Preparation: Immediately after the finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth.
- B. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Engineer may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.
- C. Mixing: Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.
- D. Application:
 - 1. Contractor shall obtain approval of hydromulch area preparation from the Engineer prior to application.
 - 2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

3. Keep hydromulch within areas designated and keep from contact with other plant material.
 4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
 5. After application, the Contractor shall not operate any equipment over the covered area.
 6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
 7. Refer also to the maintenance portion of this section.
- E. Unseeded Areas: If, in the opinion of the Engineer, unplanted skips and areas are noted after Hydromulching, the Contractor shall be required to seed the unplanted areas with the grasses that were to have been planted at no additional cost to the Owner.

3.04 INSPECTIONS

- A. Make written request for inspection prior to seeding and after areas have been seeded.
- B. Submit requests for inspections to Engineer at least two (2) days prior to anticipated inspection date.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

This Section specifies the requirements for furnishing and placing drainage pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 02220 Trenching, Backfilling and Compaction
2. Section 02401 Trench Safety

1.03 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

- A. American Society for Testing and Materials Standards (ASTM).
 1. A 48 Specification for Gray Iron Castings.
 2. A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 3. C-32 Specification for Sewer and Manhole Brick.
 4. C-76 Specification for Reinforced Concrete Culvert Pipe.
 5. C-443 Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.
 6. C 476 Specification for Grout for Masonry
 7. C-478 Specification for Precast Reinforced Manhole Sections.
 8. C 789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Sewers, and Sewers.

9. C 850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers with less than 2 ft. of Cover Subjected to Highway Loadings.
 10. D-3034 Specification for Polyvinyl Chloride (PVC) Pipe.
 11. D 3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 12. F 679 Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 13. F 758 Specification for Smooth-Wall Polyvinyl Chloride Plastic Underdrain Systems for Highway, Airport and Similar Drainage.
 14. A-7465 Specification for Ductile Iron Gravity Sewer Pipe.
- B. Texas Department of Transportation 1993 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT).
1. Item 460 Corrugated Metal Pipe.
 2. Item 462 Concrete Box Culverts and Sewers.
 3. Item 464 Reinforced Concrete Pipe
 4. Item 465 Manholes and Inlets
 5. Item 466 Headwalls and Wingwalls
 6. Item 467 Safety End Treatment
 7. Item 476 Jacking, Boring or Tunneling Pipe
 8. Item 479 Adjusting Manholes and Inlets
- C. American National Standards Institute (ANSI)
1. A21.10 Cast Iron and Ductile Iron Fittings 4" through 8" for water and other liquids.

PART 2 PRODUCTS

2.01 PIPE

- A. Reinforced concrete pipe shall conform to ASTM C-76, Class III and Class IV as shown on the plans or as necessary to meet ASTM cover design requirements.
- B. Corrugated metal pipe shall conform to TxDOT Item 460 specifications.
- C. Polyvinyl Chloride (PVC) pipe 4 to 15 inch diameter shall be SDR35 and conform to ASTM D3034. Polyvinyl chloride pipe 18 to 36 inches shall conform to ASTM F679.
- D. Precast box culverts shall conform to ASTM C 789 for sections with 2 feet or more of cover. When less than 2 feet of cover, culverts shall conform to ASTM C-850.
- E. Polyvinyl Chloride Perforated pipe and fittings shall conform to ASTM F758.
- F. Ductile Iron Pipe (DIP) shall be Class 51 and conform to ASTM A-746.

2.02 JOINTS

- A. Reinforced concrete pipe joints shall conform to ASTM C-443 Rubber Gaskets or approved equal.
- B. PVC pipe joints shall conform to ASTM D-3212 specifications.
- C. DIP pipe joints shall conform to ANSI A-21.10, latest edition.

2.03 CONCRETE

- A. All monolithic concrete sewers and structures shall use a Portland Cement mixture providing 3000 psi compressive strength in 28 days with a 2" to 4" slump. Reinforcing steel shall be grade 40 steel per ASTM A 615.
- B. Precast concrete shall conform to ASTM C-478 for manholes and inlets.

2.04 BRICK

Sewer brick for manholes, inlets and junction boxes shall conform to ASTM C-32.

2.05 MORTAR

Mortar for brick drainage structures and manholes shall conform to TxDOT Item 465.2(2) and ASTM C 476.

2.06 RIMS, GRATES AND FRAMES

Castings for manhole and inlet rims, grates and frames shall conform to ASTM A 48, Class 30B gray iron or better quality.

PART 3 EXECUTION

3.01 PIPE SEWERS

- A. Open Trench Construction
 - 1. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of trench has been properly shaped.
 - 2. Batter boards where used shall be placed into position properly. Boards shall be nominal 1 x 4 inch lumber, planed on all four sides to parallel faces. The boards and all location stakes must be protected from injury or change of location.
 - 3. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.
 - 4. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream.

5. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.
6. When trenches exceed five feet in depth the Contractor shall utilize trench safety measures per Section 02401 Trench Safety.

B. Boring, Jacking or Tunneling Construction

1. Suitable pits shall be constructed for the boring, jacking or tunneling operations. Excavations greater than 5 feet in depth shall be protected as specified in Section 2401 Trench Safety.
2. Construction operations shall be done in such a manner that the operation and structural integrity of the road or other area over the bore is not weakened or damaged in any way nor operations interfered.
3. Pits shall be filled immediately upon completion of the pipe installation.
4. Jacking operations shall meet the requirements of TxDOT Item 476.3(2).
5. Boring operations shall meet the requirements of TxDOT Item 476.3(3)
6. When pipe sizes are sufficient for tunneling methods, contractor may tunnel and jack pipe. When this method is used, special safety precautions shall be used to protect the workers involved. Any over excavation shall be filled with drilling mud after the pipe is installed.

3.02 MANHOLES, JUNCTION BOXES AND INLETS

- A. Manholes and inlets shall be constructed at locations shown on the plans and to the depth indicated thereon.
- B. Manholes may be constructed of brick, concrete or precast concrete sections and in all types shall be constructed to the dimensions shown on the plans.
- C. Inlets and junction boxes shall be constructed in accordance with the details shown on plans.
- D. Joints between precast concrete manhole and inlet sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.

- E. The construction of manholes, junction boxes and inlets shall be done as soon as practical after sewer line into or through the manhole, junction box or inlet locations are completed.
- F. All sewers shall be cut neatly at the inside face of the walls of the manhole, junction box or inlet and pointed up with mortar.
- G. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.
- H. The inverts of the sewer line or several sewer lines entering the manhole or junction box at or near the flow line elevation of the manhole or junction box shall be shaped and routed across the floor of the manhole or junction box using mortar to obtain the proper contour.

3.03 FRAMES, GRATES, RINGS AND COVERS

- A. Castings shall conform to the type shown on the plans and shall be clean substantial castings, free from sand or blow holes or other defects.
- B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.
- C. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.
- D. Castings in pavement areas or areas designated to receive traffic loading shall be a heavy duty type capable of H-20 loading.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding and the construction of temporary swales and *sedimentation basins as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction shall be adequately block sodded or hydromulched and watered until growth is established. In developed areas where grass is present, block sod may be required.
- B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System regulations from the Clean Water Act.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02210 Site Grading
- B. Section 02220 Trenching, Backfilling and Compaction
- C. Section 02500 Drainage

PART 2 PRODUCTS

2.01 GRASS

- A. Materials for seeding shall conform to TxDOT Item 164.
- B. Materials for sodding shall be Common Bermuda Grass.

2.02 FERTILIZER

Use commercial grade fertilizers to insure germination and growth.

2.03 WATER

Use clean potable water for maintaining the grass.

2.04 SILT FENCE

Lundin "Silt Buster", Mirafi "Envirofence" or approved equal.

2.05 SEDIMENT TRAPS

Standard manufacture designed to fit the intended inlet.

PART 3 EXECUTION

3.01 SEEDING

- A. Exposed fill and stockpile areas shall be seeded if the phasing of the construction operations are anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. Seeding operations shall be performed in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.3(2) unless otherwise instructed.
- B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.
- C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.02 TEMPORARY SWALES

A. DESCRIPTION

- 1. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.
- 2. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.
- 3. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.
- 4. Swales shall have erosion control barriers as required.
- 5. Permanent swales shall be sodded per TxDOT Item 162.

B. MAINTENANCE

- 1. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, all temporary swales to remain shall be placed in good working condition.
- 2. Contractor shall work with other contractors at the site in maintaining existing swales and ditches.

3. Where necessary for access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.

3.03 FILL AND CUT SLOPES

- A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's soils engineer.
- B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.
- C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulching, sodding, seeding, or other method as approved.

3.04 SEDIMENTATION BASINS

A. DESCRIPTION

1. Sedimentation ponds shall be provided when designated on the plans.
2. All drainage from cleared areas shall be routed through the sedimentation basin.
3. Contractor will be responsible for the operation and maintenance of the pond during construction.

B. MAINTENANCE

1. Contractor shall be responsible for maintaining the pond and the outfall and sediment retarding structure in good working condition throughout the time the pond is to be in operation.
2. When sediment and debris fill the pond to over one third (1/3) its designed capacity, the pond shall be cleaned out.
3. The sediment from the clearing operation shall be stockpiled in its own separate area or removed from the site, as required, and adequate drainage provisions must be made such that drainage from the sediment stockpile drains back into the sediment pond.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

This section specifies the requirements for furnishing and installing sanitary force main and appurtenances. The pipe shall be of the type and size as shown on the plans and constructed in accordance with these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02220 Trenching, Backfilling and Compaction
- B. Section 02401 Trench Safety

1.03 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by reference thereto:

- A. American National Standards Institute (ANSI).
 - 1. A21.51 Ductile Iron Pipe, Centrifugally Cast, in Metal Molds or Sand Lined Molds, for Water or Other Liquids.
 - 2. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125.
- B. American Water Works Association (AWWA).
 - 1. C-111 American National Standard for Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.
 - 2. C-151 American National Standards for Ductile-Iron Pipe.

PART 2 PRODUCTS

2.01 PIPE

- A. All materials and equipment shall be new, of best grade and standard manufacture.
- B. Ductile iron pipe shall conform to ANSI A21.51, latest edition. Thickness class shall be determined per AWWA C 151. Wrap pipe in polyethylene per AWWA C 105.

2.02 FITTINGS

- A. All materials and equipment shall be new, of best grade and standard manufacture.
- B. Cast iron fittings shall conform to ANSI B16.1, latest edition, Class 125, when using Ductile Iron Force Main.
- C. Cast iron fittings shall conform to AWWA C 111 when using PVC force main.
- D. Wrap cast iron fittings with polyethylene per AWWA C 105.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The interior of the pipe shall be kept relatively cleaned of all foreign matter before lowered into the trench, and shall be kept clean during these operations.
- B. Pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work.
- C. When work is not in progress, open ends of pipes and fittings shall be securely closed so that water, earth, or other substances will not enter the pipes or fittings.
- D. All bends, tees and plugs shall have thrust blocks installed where applicable.
- E. Air release valves and cleanouts shall be installed at intervals as indicated on the plans. These fixtures shall be sufficient to withstand 200 psi surge in pressure.

3.03 TESTING

- A. The sanitary force main to be installed shall be hydrostatic tested as per this specification.
- B. Hydrostatic Test
 - 1. General
 - a. After the pipe has been laid and initial backfill completed, the force main shall be subjected to a hydrostatic pressure of 150 psi.
 - b. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test.
 - 2. Procedures
 - a. Before applying the specified pressure test, all air shall be expelled from the pipe.

- b. All pipe, fittings, and joints will be examined during testing.
- c. Any defective material shall be replaced with sound material and the test repeated until satisfactorily completed and approved.
- d. Allowable leakage shall not exceed 25 gallons per inch of diameter per mile of pipe per 24 hours.
- e. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered, shall be replaced, regardless of total leakage shown.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE:

- A. This section specifies the requirements for furnishing and installing submersible pumps and equipment for sanitary sewer lift station and appurtenances. The pipe shall be of the type and size as shown on the plans and constructed in accordance with these specifications.

1.02 SUBMITTALS

- A. Submit the following in accordance with Section 1600, paragraph 4, Shop drawings and submittals:
 - 1. Catalog data.
 - 2. Pump curves.
 - 3. Operation and maintenance data.
 - 4. Theory of operation.
 - 5. Test procedure.
 - 6. Warranties.

1.03 WARRANTY

- A. Manufacturer's printed warranties shall apply to pumps.
- B. Provide five years or 10,000 hours warranty after installation, including parts and labor.
- C. Provide for repairs to be performed at the manufacturer's authorized warranty repair station located within a 200 mile radius of this Project.

PART 2 PRODUCTS

2.01 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 1600, Substitution of Materials, Labor and Equipment.

2.02 ACCEPTABLE MANUFACTURER

- A. Flygt - No Substitutions.
- B. Pumps shall be readily removable and replaceable without de-watering wet well or disconnecting any piping in wet well.

2.03 PERFORMANCE AND DESIGN REQUIREMENTS

A. See Schedule in PART 3.

2.04 PUMP MATERIALS

A. Volute, impeller, motor housing, discharge elbow, and other components: Gray cast iron, ANSI Class 30.

B. Shaft: Stainless steel or carbon steel.

C. Motor:

1. Rotor bars and short circuit rings: Aluminum.

2. Windings: Copper.

3. Stator winding and lead insulation: NEMA Class F.

D. Mechanical Seals:

1. Lower: Tungsten carbide/tungsten carbide.

2. Upper: Tungsten carbide/carbon.

E. Wear Ring:

1. Case wear ring: Steel with molded nitrile rubber.

2. Impeller wear ring: ANSI 304 stainless steel. Provide on pump greater than 15 HP.

F. Exposed Nuts and Bolts: ANSI 304 stainless steel.

2.04 PUMP CONSTRUCTION

A. Water Tight Sealings: Nitrile rubber O-rings against machined surfaces.

B. Cable Entry Design:

1. Seal: Torque-free mechanical compression type with strain relief. Do not use epoxies, silicones, or other secondary sealing. Submersible cable entry shall be field replaceable without replacing cable.

2. Seal junction chamber from motor by terminal board and an elastomer compression seal.

C. Pump Motor:

1. Squirrel cage induction type, housed in air-filled watertight chamber.

2. Dip and bake stator three times in NEMA Class F varnish and heat shrink fit into the stator housing. Do not use designs requiring penetration of stator housing.
 3. Motor cooling system:
 4. Thermal radiators integrally cast into stator housing, up to 10.5 HP.
 5. Circulation of pumped media through a cooling jacket for 15 HP and larger.
- D. Pump Shaft Bearings:
1. Permanently lubricated ball bearings.
 2. Upper Bearing: Single row deep groove.
 3. Lower Bearing: Two-row angular contact.
 4. Sealed completely from pump liquid.
- E. Minimum B10 Bearing Life: 20,000 hours at any point on head-capacity curve.
- F. Mechanical Seals: Tandem independent and run in a standard motor oil reservoir.
- G. Impeller: Dynamically balanced, double shrouded, non-clog, single vane capable of handling 3 inch diameter solids, unless otherwise scheduled.
- H. Equip each pump with stainless steel lifting chain and submersible pump cable.
- I. Provide sliding guide bar bracket unit to guide on at least two rails which is an integral part of pump unit. Do not permit any portion of the pump or guidance system to bear on sump floor. Do not use guide cables.
- J. Provide metal-to-metal discharge pump/elbow connection seal. Do not use diaphragm or O-ring type seals.

2.05 PERFORMANCE

- A. Pump motor:
1. 3 phase motor.
 2. Non-overloading throughout pump curve.
 3. Capable of 15 evenly spaced starts per hour.
 4. Capable of running dry indefinitely without damage.
 5. Motor shall be rated for the site elevation.

2.06 PROTECTIVE COATING

- A. Pump Exterior: PVC epoxy primer and chloric rubber paint finish.
- B. Impeller: PVC epoxy or rislan.

2.07 ACCESSORIES

- A. Pump accessories supplied by pump manufacturer.
- B. Provide pump accessories required for proper installation and/or as recommended by manufacturer, including the following.
 - 1. Upper and intermediate guide bar brackets with stainless steel nuts and bolts.
 - 2. Stainless steel guide rails and brackets with stainless steel nuts and bolts.
 - 3. Stainless steel lift chain.
 - 4. Safety chain hook.
 - 5. Portable Hoist Frame above for pump removal
 - 6. Cable holder for pump cable and float cable.
 - 7. Cable support grip.
 - 8. Anchorage.
 - 9. Cable rack for high level float.
 - 10. Self-weighted float switch, Flygt Model ENH-10.
 - 11. Check valve, flanged ends, line size, Flygt Model HDL 5087.
 - 12. Plug valve, eccentric, flanged ends, line size, BUNA packing, neoprene plug facings, lever handle, DeZuric series 100, Fig. No. 118.
 - 13. Standard discharge connection.
 - 14. Wet Well: Aluminum access frame and cover, single door with spring assist, 48 inches x 36 inches, with stainless steel hinges and accessories, locking mechanism to accept a Best brand City of Houston padlock, and hinged safety grating built-in.
 - 15. Dry Well: Aluminum access frame and cover, single door, 36 inches x 36 inches, with stainless steel hinges and accessories, and locking mechanism to accept a Best brand City of Houston padlock.

- C. Transducer Containment Fittings:
 - 1. 8 x 6 inch PVC Schedule 40 reducer coupling.
 - 2. 8 inch PVC Schedule 40 cap.
 - 3. 8 inch Schedule 40 pipe.
- D. Controls:
 - 1. RACO Verbatium – No substitute, including the following.
 - a. Enclosure – NEMA 4X.
 - b. Environmental – Heater.
 - c. Local alarm relay output.
 - 2. Milltronics Hydro-Ranger 200, Part No. 7ML1034 - 1AA1 with Echomax XPS-10 transducer, Part No. 7ML1115 - 0CA31.
 - 3. NEMA 4X enclosure box for mounting of RACO Verbatium outside of, but attached to, motor control center. Provide connections in motor control center for RACO Verbatium unit.
 - 4. Telephone line grounding/terminator box, Hoffman No. A-1086CHQRFQ, with 1/2 inch plywood backing plate mounted inside. Mount box beside and connect to the RACO Verbatium box with 3/4 inch conduit nipple.
 - 5. RACO Verbatium enclosure and backplate, Hoffman No. A-201608LP and No. A-20P16.

2.08 MOTOR CONTROL CENTER

- A. Duplex pump control panel supplied by pump supplier.
 - 1. Manufacturer: E.G. Pumps Controls.
- B. Provide duplex pump controls required for proper installation and/or as recommended by manufacturer including the following:
 - 1. If MCC is required provide it with separate cubicle to accommodate Milltronics unit with glass view port on door.
 - 2. Two pump Circuit Breakers: UL interrupting rating not less than 14,000 amperes RMS symmetrical at 480 volts or 22,000 amperes RMS symmetrical at 240 volts.
 - 3. Two NEMA rated, full voltage non-reversing motor starters.
 - 4. Duplex Logic Chassis (an anodized aluminum sub-assembly) with Logic Panel Including:
 - 5. Two Hand-Off-Auto selector switches.

6. Two run pilot lights (red).
7. Two off pilot lights (green).
8. Level alarm pilot light.
9. Alarm silence pushbutton.
10. Motor over temperature sensor – shut pump down.
11. LED status indication pilot lights for each relay function.
12. GFCI duplex convenience receptacle. Mount inside on front plate.
13. Space heater to prevent condensation within the enclosure.
14. Ground lugs for pump and service connections.
15. Enclosure NEMA 3R.
16. Additional control breaker - 15 amp, 1 pole.
 - a. Control power transformer - 2 KVA, 16.7 amps.
 - b. Phase Monitor Relay, 200-240 volt or 440-480 volt, 3 phase as required; capable of detecting loss of a single phase, under-voltage, over voltage, and voltage unbalance. Alarm will be sent to the RACO Verbatim unit.
 - c. Lightning surge arrester.
 - d. Elapsed time meter for each pump.
 - e. Lag pump time delay relay.
 - f. Seal failure relay, Flygt, with pilot light.
 - g. Audible Alarm horn, 93 dB at 20 feet.
 - h. Alarm beacon with flasher.
 - i. Alarm memory circuit to maintain alarm beacon until manually reset.
 - j. Alarm and control enclosure.
 - k. Additional isolated dry contacts.
 - l. Motor over-temperature (2) - contact type form "C".
 - m. Motor overload trip (2) - contact type normally open.
 - n. Seal failure (2) - contact type form "C".
 - o. Power failure - contact type form "C".
 1. High level float status light.
 2. High level float test switch.
 3. Local control panel disconnect. Mount beside, but exterior to, the control panel.
 4. Main breaker.
 5. Operating voltage sign and station name.
 6. pH enclosure, Hoffman No. U-U504030.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Wet well and dry well shall be fabricated and installed per the Walter P. Moore Contract Drawings per City of Houston Construction Manhole Specification Manholes and Structures.
 - 1. Wet well bottom and walls shall be coated with a two-part, high build epoxy lining. Material shall have chemical resistance and designed as a structural lining for manholes and vessels in wastewater facilities.
 - 2. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer before applying lining.
 - 3. Apply products in accordance with manufacturer's instructions.
 - 4. Material will be 100% solids by volume.
 - 5. Manufacturer: Raven Lining Systems.
- B. Install pumps and equipment in accordance with manufacturer's instructions, and Contract Drawings and Specifications.
- C. Install pumps level, plumb, accurately aligned, with leak-proof pump connection, and easily removed without entering wet well.
- D. Install all electrical equipment and electrical boxes outside of lift station pit except.
 - 1. Install Millitronics Hydro-Ranger in electrical motor control center.
 - 2. Adjust settings as directed by directed by MDACC plumbing personnel.
- E. Make no splices in cable.
- F. Furnish and install all power connections to and from the control box in accordance with provisions of Division 16.
- G. Provide communications link between the lift station monitoring/controls and the City of Houston Plant system. System shall be installed and available for testing during the Acceptance Inspection.

3.02 HIGH LEVEL FLOAT

- A. Suspend on bracket as shown on Drawings.
- B. Make no splices in cable.
 - 1. Adjust float level as shown on contract drawings or per city of Houston plumbing personnel.

3.03 MANUFACTURER'S ON-SITE SERVICE

- A. Arrange for a factory trained service engineer to be present to check installation and operation.
- B. Arrange for a factory trained service engineer to provide a minimum of 4 hours per pump station of training to operating personnel on operation and maintenance of pumping equipment.
- C. Provide a report by the service engineer certifying that equipment has been installed and is operating correctly.

3.04 ACCEPTANCE INSPECTION, TESTING, ADJUSTING, AND TIE-IN

- A. Notify City of Houston and Walter P Moore Representative at least 10 working days in advance to perform the following:
 - 1. Visual inspection of gravity and force main sewer lines.
 - 2. Inspection, testing, and adjusting of alarms and controls on lift station.
 - 3. Inspection of lift station for compliance with drawings and specifications.
 - 4. Tie-ins to existing sanitary sewer system.
 - 5. Documentation shall be submitted to the City of Houston and Walter P Moore representative prior to utility tie-in.

3.05 EQUIPMENT SCHEDULE

- A. Flygt Model [NP3127-422LT] with Impeller Model [422] and [CP3068-256HT with Impeller Model [256]
 - 1. GPM/TDH (feet): [712/30](NP3127) and [125/23] (CP3068)
 - 2. HP: [8.5](NP3127) and [2.3] (CP3068)
 - 3. Discharge Pipe (inches):[4]
 - 4. RPM: [1750](NP3127) and [3415](CP3068)
 - 5. Volts/Phase: [460V / 3 Phase]
 - 6. Max motor Input at design point (KW):[6.34](NP3127) and [1.72](CP3068)
- B. Site elevation: 23.50 feet.

END OF SECTION