INDEX OF TECHNICAL SPECIFICATIONS

01005 – Definitions and Terminology
01040 – Project Administration
01300 – Submittals
01310 – Project Schedule
01411 – Environmental Protection
01460 – Laboratory Testing and Inspection Services
01564 – Ground Water Handling
01568 – Erosion and Sediment Control during Construction
01700 – Project Closeout Procedures
02101 – Preparation of Right of Way
02102 – Clearing & Grubbing
02103 – Concrete Removal
02104 – Building Demotion
02210 – Grading & Earthwork
02220 – Subgrade Preparation
02221 – Trench Excavation Backfill & Compaction
02223 – Trench Excavation Protection Table
02223.1 – Trench Protection Table
02230 – Excavation
02234 – Borrow
02236 – Embankment
02240 – Lime Stabilization
02936 – Seeding
09101 – Construction Traffic Control
09102 – Filter Fabric
00156 – Bulldozer Work
00158 – Specialized Excavation Work
00351 – Flexible Pavement Structure Repair
00360 – Concrete Pavement
00361 – Full-Depth Repair of Concrete Pavement
00464 – Reinforced Concrete Pipe
00465 – Junction Boxes, Manholes, and Inlets
00479 – Adjusting Manholes and Inlets
00481 – Pipe for Drains
00550 - Chain Link Fence
00752 – Tree and Brush Removal
07042 – Slip-in Inline Check Valves
31221 - Fine Grading
32800 - Irrigation
32841 - Vegetative Watering
32920 - Lawns & Hydromulch

SECTION 01005 DEFINITIONS AND TERMINOLOGY

PART 1 - GENERAL

1.01 SPECIFICATION TERMINOLOGY

A. “Certified” used in context with materials and equipment means the material and equipment has been tested and found by a nationally recognized testing laboratory to meet specification requirements, or nationally recognized standards if requirements are not specified, and is safe for use in the specified manner. A nationally recognized testing laboratory must periodically inspect production of the equipment and the equipment must bear a label, tag, or other record of certification.

B. “Certified” used in context with labor performance or ability to install materials and equipment means that the abilities of the proposed installer have been tested by a representative of the specified testing agency authorized to issue certificates of competency and has met the prescribed standards for certification.

C. “Certified” used in context with test reports, payment requests or other statements of fact means that the statements made on the document are a true statement as attested to by the certifying entity.

D. “Engineer” shall mean the Consulting Engineer with the Owner for this particular project, or its designated representative.

E. ‘Furnish” means to supply, deliver and unload materials and equipment at the project site ready to install.

F. “Indicated” means graphic representations, notes, or schedules on drawings, or other requirements in Contract Documents. Words such as “shown’, “noted’, “scheduled”, are used to help locate the reference. No limitation on the location is intended unless specifically noted.

G. “Install” means the operations at the project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, training and similar operations required to prepare the materials and equipment for use, verify conformance with Contract Documents and prepare for acceptance and operation by the Owner.

H. “Installer” means an entity engaged by Contractor, either as an employee, subcontractor, or sub-subcontractor to install materials and/or equipment. Installers are to have successfully completed a minimum of five projects similar in size and scope to this project, have a minimum of five years of

experience in the installation of similar materials and equipment, and comply with the requirements of the authority having jurisdiction.

I. “Labeled” means equipment that embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc. and production is periodically inspected in accordance with nationally recognized standards or tests to determine safe use in a specified manner.

J. “Listed” means equipment is included in a list published by a nationally recognized laboratory which makes periodic inspection of production of such equipment and states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

K. “Manufacturer” means an entity engaged by Contractor, as a subcontractor, or sub-subcontractor to furnish materials and/or equipment. Manufacturers are to have a minimum of five years experience in the manufacture of materials and equipment similar in size, capacity and scope to the specified materials and equipment.

L. “Perform” means to complete the operations necessary to comply with the Contract Documents.

M. “Owner” means the Edinburg Consolidated Independent School District (ECISD).

N. “Project site” means the space available to perform the work, either exclusively or in conjunction with others performing construction at the project site.

0. “Provide” means to furnish and install materials and equipment.

P. “Regulations” means laws, statutes, ordinances, and lawful orders issued by authorities having jurisdiction, as well as, rules, conventions, and agreements within the construction industry that control performance of work, whether they are lawfully imposed by authorities having jurisdiction or not.

Q. “Specified” means written representations in the bid documents or the technical specifications.

1.02 SPECIFICATION SENTENCE STRUCTURE

A. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type even though the word “all” is not stated.

B. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words “furnish”, “install”,

"provide", or similar words include the meaning of the phrase "The Contractor shall.' before these words.

C. It is understood that the words "directed", 'designated", requested", 'authorized", "approved", "selected', or similar words include the meaning of the phrase "by the Engineer" after these words unless otherwise stated. Use of these words does not extend the Engineers responsibility for construction supervision or responsibilities beyond those defined in the General Conditions.

D. "At no additional cost to Owner", "with no extra compensation to Contractor", "At Contractor's own expense", or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

1.03 DOCUMENT ORGANIZATION

A. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among subcontractors, or to establish the extent of work to be performed by any trade, subcontractor or vendor. Specification or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.

B. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.

C. Capitalizing words in the text does not mean that these words convey special or unique meanings or have precedence over other parts of the Contract Documents. Specification text governs over titling and it is understood that the specification is to be interpreted as a whole.

D. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.

1.04 INTERPRETATIONS OF DOCUMENTS

A. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract

Documents indicate otherwise.

1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.

2. Actual installation may comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.

3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.

4. Refer instances of uncertainty to the Engineer for a decision before proceeding.

B. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawings but are not included in the specifications.

1.05 REFERENCE STANDARDS

A. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract, Documents where Contract Documents include more stringent requirements than the referenced standards.

1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.

2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.

B. Consider a referenced standard to be the latest edition with supplements or amendments when a standard is referred to in an individual specification section but is not listed by title and date.

C. Trade association names and title of general standards are frequently abbreviated. Acronyms or abbreviations used in the Contract Documents mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable in the context of the Contract Documents.

D. Make copies of reference standards available as requested by Engineer or Owner.

1.06 SUBSTITUTIONS AND EQUAL PRODUCTS

Provide materials and equipment manufactured by the entities specifically listed in each technical specification section. Submit a Contractors Modification Request per Section 01300, SUBMITTALS for substitution of materials and equipment of manufacturers not specifically listed or for materials and equipment that does not strictly comply with the Contract Documents. Contractor may provide “equal” products manufactured by manufacturers other than those specifically listed in the technical specification section unless it is specifically stated that only the materials and equipment of the specified manufacturers shall be provided. Provide a request for approval of proposed equals per Section 01300 SUBMITTALS for any materials or equipment not specifically listed. Submit a Contractors Modification Request for substitution of materials and equipment of other manufacturers or for materials and equipment that does not strictly comply with the Contract Documents. A Field Order or Change Order will be issued if the contract modification is approved.

END OF SECTION

SECTION 01040 PROJECT ADMINISTRATION

PART 1- GENERAL

1.01 WORK INCLUDED

A. Administer contract requirements to construct the project. Provide documentation per the requirements of this Section. Provide information as requested by the Engineer/Architect or Owner concerning this project.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01300, SUBMITTALS.

1.03 COMMUNICATION DURING THE PROJECT

A. The Engineer is to be the first point of contact for all parties on matters concerning this project.

B. The Engineer will coordinate correspondence concerning:
   1. Submittals, including requests for payment
   2. Clarification and interpretation of the Contract Documents
   3. Contract modifications
   4. Observation of work and testing
   5. Claims

C. The Engineer will normally communicate only with the Contractor. Any required communication with suppliers or subcontractors shall only be with the direct involvement of the Contractor.

D. Written communications are to be directed to the Engineer at the address indicated in the Pre-construction Conference. Communications should include as a minimum:

   1. Name of the Owner

   2. Project name

   3. Contract title

   4. Project number

   5. Date

   6. A reference statement

E. Submit communications on the forms referenced in this Section or in Section 01300. SUBMITTALS.

1.04 PROJECT MEETINGS

A. Pre-construction Conference

1. Attend a pre-construction meeting.

2. The location of the conference will be determined by the Owner.

3. The time of the meeting will be determined by the Owner but will be after the Notice of Award is issued and not later than fifteen (15) days after the Notice to Proceed is issued or can be issued at the Pre-Construction Conference.

4. Meeting will be attended by the Owner, Engineer and the Contractors project manager and superintendent. Meeting may be attended by representative of utility companies and representatives from major subcontractors and suppliers.

5. Contractor should provide and be prepared to discuss:
   a. Preliminary construction schedule per Section 01310, PROGRESS SCHEDULE.
   b. Preliminary Submittal Schedule.
   c. Schedule of values and anticipated schedule of payments.
   d. List of Suppliers and Subcontractors.
   e. Contractor's organizational chart as it relates to this project.
   f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents.

B. Periodical Progress Meetings

1. Attend meetings with the Engineer and Owner.

   a. Meet on a Monthly basis or as requested by the Engineer to discuss the project.

   b. Meet at the project site or other location as designated by the Engineer.

   c. Contractors superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.

2. Provide information as requested by the Engineer or Owner concerning

this project.

a. Prepare to discuss:

1) Status of overall project schedule.

2) Contractors detailed schedule for the next month.

3) Anticipated delivery dates for equipment.

4) Coordination with the Owner.

5) Status of submittals.

6) Information or clarification of the Contract Documents.

7) Claims and proposed modifications to the contract.

8) Field observations, problems, or conflicts.

9) Maintenance of quality standards.

b. Notify the Engineer of any specific items to be discussed a minimum of one (1) week prior to the meeting.

3. Review minutes of meetings and notify the Engineer of any discrepancies within ten (10) days of the date of the memorandum.

a. Following that date, the minutes will stand as shown or as corrected.

b. Corrections will be reflected in the minutes of the following meeting.

c. Each item of business shall be numbered to indicate the meeting number and the item number. Items discussed will be documented and old business items will remain on minutes of subsequent meetings until the item is resolved.

1.05 REQUESTS FOR INFORMATION

A. Submit Request for Information (RFI) to the Engineer to obtain additional information or clarification of the Contract Documents.

1. Submit a separate RFI for each item.

2. Attach adequate information to permit a written response without further clarification. Engineer will return requests which do not have adequate

information for additional information.

3. A response will be made when adequate information is provided. Response will be made on the RFI form or in attached information.

4. Assign a number to the RFI and sequence number in chronological order.

B. If the RFI indicates that a contract modification is required, the Engineer will initiate a Proposed Contract Modification (PCM) per Section 1.07.

1.06 NOTIFICATION BY CONTRACTOR

A. Notify the Engineer of:

1. Need for testing.

2. Intent to work outside regular working hours.

3. Request to shut down facilities or utilities.

4. Proposed utility connections.

5. Required observation by Owner or inspection agencies prior to covering work.

B. Notification must be provided in time for Owner and Engineer to respond appropriately to the notification.

C. Use “Notification By Contractor” form. Form can be requested from Owner or Engineer.

1.07 REQUESTS FOR MODIFICATIONS

A. Submit a request to the Engineer for any change in the Contract Documents or approval of any deviations from the Contract Documents.

1. Use the “Contractors Modification Request” (CMR) form. Contractor’s own form can also be submitted pending completeness of required information.

a. Assign a number to the CMR when issued and sequence number in chronological order.

b. Include with the CMR:

1) A complete description of the proposed modification.

2) The reason the modification is requested.

3) A detailed breakdown of the cost of the change (necessary only if the modification requires a
change in contract amount). The itemized breakdown is to include:
(a) list of materials and equipment to be installed,

(b) man hours for labor by classification,

(c) equipment used in construction,

(d) consumable supplies, fuels, and materials,

(e) royalties and patent fees,

(f) bonds and insurance,

(g) overhead and profit,

(h) field office costs,

(i) home office cost,

(j) and other items of cost.

4) A revised schedule indicating the effect on the critical path for the project and a statement of the number of days the project may be delayed by the modification.

2. A CMR is required for field changes.

   a. Request must be made a minimum of two (2) weeks in advance of performing the work affected.

   b. Request for field changes will be submitted to the Engineer.

3. A CMR is required for all substitutes or deviations from the Contract Documents.

4. Engineer will evaluate the request for a contract modification.

B. Owner will initiate changes through the Engineer.

1. Engineer will prepare a description of the proposed modifications to the Contract Documents.

2. Engineer will use the “Proposed Contract Modification’ form or own form. Engineer will assign a number to the PCM when issued and keep in numerical order throughout project.

3. Return request with a proposal to incorporate the requested change. Include a breakdown of costs into materials and labor in sufficient detail to allow evaluation by the Engineer.

C. If a contract modification is required, the Engineer will issue a Field Order or a Change Order.

1. Modifications to the contract can only be made by a Field Order or a Change Order.

2. Changes in the project will be documented by Field Order or by a Change Order.

3. Field Orders may be issued by the Engineer for contract modifications that do not change the contract amount or contract time.

4. Any modifications that require a change in contract amount or contract time can only be approved by Change Order.

a. CMR’s and proposals issued by the Contractor in response to a PCM will be evaluated by the Engineer.

b. If change order is recommended, the Engineer will prepare the change order.

c. The Change Order will be sent to the Contractor for execution with a copy to the Owner recommending approval.

d. Change Orders can only be approved by the Owner.

1) Work performed on the proposed contract modifications prior to the approval of the Change Order will be performed at the Contractor’s risk.

2) No payment will be made for work on Change Orders until approved by the Owner.

D. The Contractor may be informed that the proposed modification is not approved and construction is to proceed in accordance with the Contract Documents.

1.08 EMERGENCY WORK

A. Notify the Owner and Engineer immediately of any additional work that must be performed to prevent injury or damage to existing structures, facilities, utilities, or work in place.

B. When possible, obtain authorization from the Owner before proceeding.

1.09 CLAIMS

A. Do not perform any work which is considered to be outside the scope of the Contract Documents without an approved Change Order.

B. File notice of claims with the Engineer within 10 days of the event giving rise to the claim.

C. Provide full documentation within 30 days of the notice.

D. Items not reported within the stipulated time will not be considered.

1. Failure to notify the Owner of potential claims does not allow the Owner to take alternative action to prevent the Contractor from incurring the cost for the item or to perform the work in a different manner.

2. Failure to notify the Owner does not allow operations to be monitored for the actual cost of performing the work.

E. When full documentation has been received by the Engineer, the claim will be reviewed in the context of the Contract Documents.

1. If the claim is valid, a Change Order will be prepared and payment of the Change Order will be recommended.

2. If the claim is not valid, then the claim will be denied with an explanation of the reasons.

3. Should the Contractor disagree with the decision of the Engineer, the Contractor may refuse to do the work.

a. If the Owner insists that the work be done, proceed with the work on a time and materials basis.

b. The validity of the claim will be resolved at a later time in accordance with the Contract Documents.

1.10 RECORD DOCUMENTS

A. Maintain at the site one (1) complete record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Contract modifications
5. Approved shop drawings and record data
6. One (I) set of construction photographs
7. Test records
8. Clarifications and other information provided in RFI responses.

B. Marking Drawings

1. Label each document as “Project Record” in large printed letters.
2. Record information as construction is being performed.

a. Do not conceal any work until the required information is recorded.

b. Mark drawings to record actual construction, including the following:

1) Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.

2) Horizontal and vertical locations of underground utilities and appurtenances constructed and existing utilities encountered during construction.

3) Location of internal utilities and appurtenances concealed in the construction. Make reference to permanent structure on the surface. Include the following equipment:

(a) Piping

(b) Ductwork

(c) Equipment and control devices requiring periodic maintenance or repair

(d) Valves, unions, traps, and tanks

(e) Services entrance

(f) Feeders
(g) Outlets

4) Changes of dimension and detail.

5) Changes made by Field Order and Change Order.

6) Details not on the original Contract Drawings.

c. Mark specifications and addenda to record materials and the equipment provided.

1) Record manufacturer name, trade name, catalog number, and each supplier (with address and phone number) of each product and item of equipment actually installed.

2) Record changes made by Field Order and Change Order.

d. Mark additional work or information in erasable pencil.

1) Use red for new or revised indication.

2) Use purple for work deleted or not installed (lines to be removed).

3) Highlight in yellow the items constructed per the plans.

e. Submit record documents to Engineer for review and acceptance 30 days prior to final completion of the project.

1) Provide one (1) set of marked up drawings.

2) Provide one (1) set of specifications.

f. Partial Payment Requests will not be recommended for payment if record documents are found to be: incomplete or not in order. Final payment will not be recommended without record documents.

PART 2- PRODUCTS (NOT INCLUDED)

PART 3- EXECUTION (NOT INCLUDED)

END OF SECTION

SECTION 01300 SUBMITTALS

1.00 PART 1 - GENERAL

1.01 WORK INCLUDED

A. Contractor shall submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:

1. Record the products incorporated into the Project for the Owner.

2. Provide information for operation and maintenance of the Project.

3. Provide information for the administration of the Contract.

4. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, with the design concepts of the Contract Documents.

B. Contractors responsibility for full compliance with the Contract Documents is not relieved by the Engineers review of submittals, Contract modifications may only be approved by Change Order or Field Order.

1.02 CONTRACTORS RESPONSIBILITIES

A. Review all submittals prior to submission.

B. Determine and verify:

1. Field measurements.

2. Field construction requirements.

3. Location of all existing structures, utilities and equipment related to the submittals.

4. Submittals are complete for their intended purpose.

5. Conflicts between the submittals related to the various subcontractors and suppliers have been resolved.

6. Quantities and dimensions shown on the submittals.

C. Submit information per the procedures described in this section and the detailed specifications.

D. Furnish the following submittals:

1. As specified in the attached Submittal Schedule.

2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.

3. Submittals as required in the detailed specifications.

4. Submittals not required will be returned without Engineer's review.

E. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the project.

1. Submittals shall be sent to Engineer allowing a reasonable time for delivery, review and marking submittals. Time for review is to include time for resubmission if necessary and to allow adequate time for the ordering, fabrication, and delivery of the product.

2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.

F. Installation of any products prior to the approval of shop drawings is done at the Contractors risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owners option.

G. Payment will not be made for products for which submittals are required until the submittals have been approved. Payment will not be made for products for which shop drawings or samples are required until these are approved by the Engineer.

1.03 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting this criteria will be returned without review.

B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including drawings and specifications as modified by Addenda, Field Orders and Change Orders.

C. Furnish and install products that fully comply with the information included in the submittal.

D. Review and approve submittals prior to submitting them to the Engineer for review. Submittals will not be accepted from subcontractors, suppliers, or anyone other than the Contractor.

1.04. OPERATION AND MAINTENANCE MANUAL

A. The Contractor shall obtain from the various Subcontractors various operation and maintenance data, replacement parts lists, maintenance schedule requirements, etc., and bind the information into a reference manual. Two sets shall be turned over to the Engineer/Architect prior to request for final payment.

B. Operation and maintenance manuals shall be neatly bound with each trade so indexed. In some cases, approved shop drawings and submittals may suffice for use in this regard. Equipment parts lists for replacement purposes shall be included wherever possible.

1.05 SUBMITTAL PROCEDURES

A. Deliver submittals to the Engineer.

B. Assign a number to the documents originated to allow tracking of the submittal during the review process.

1. Assign a number consisting of a prefix. a sequence number, and a letter suffix. Prefixes shall be as follows:

Prefix	Description	Originator
CO	Change Order	Contractor
CTR	Certified Test Report	Contractor
EIR	Equipment Installation Report	Contractor
FO	Field Order	Engineer
NBC	Notification by Contractor	Contractor
O&M	Operation & Maintenance Manuals	Contractor
PCM	Proposed Contract Modification	Engineer
PR	Payment Request	Contractor
PP	Project Photographs	Contractor
RD	Record Data	Contractor
RFI	Request for Information	Contractor
SAM	Sample	Contractor
SD	Shop Drawing	Contractor
SCH	Schedule of Progress	Contractor

2. Issue sequence numbers in chronological order for each type of submittal.

3. Issue numbers for re-submittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Engineer for processing. For example: SD-025-A represents a shop drawing that is the twenty-fifth submittal of his type and is the second time this submittal has been sent for review.

4. Clearly note the submittal number on each page or sheet of the submittal.

5. Correct assignment of numbers is essential since different submittal types are processed in different ways.

D. Submit documents with uniform markings and page sizes.

1. Paper size shall allow for ease of reproduction.

   a. Submit documents on 8-1/2" X 11" paper here practical.

   b. Use II' X 17" paper for larger drawings and schematics.

   c. Use full size blueline sheets for fabrications and layout drawings. Reproducible drawings may be submitted in lieu of bluelines.

2. Mark submittals to:

   a. Indicate Contractors corrections in green.

b. Highlight items pertinent to the products being furnished in yellow and delete items that are not when the Manufacturers standard drawings or information sheets are provided.

c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.

d. Mark dimensions with the prefix FD to indicate field verified dimensions on the drawings.

e. Provide a blank space 8” x 3” for Contractor’s and Engineers stamp.

E. Mark submittals to reference the drawing number and/or section of the specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

F. The number of copies of each submittal to be sent by the Contractor and the number of copies of each submittal to be returned are:

Prefix	Description	No. of Copies Sent	No. of Copies Returned
CO	Change Order	2	1
CTR	Certified Test Report	2	0
EIR	Equipment Installation Report	2	0
NBC	Notification by Contractor	2	1
O&M	Preliminary O&M Manuals	2	1
O&M	Final O&M Manuals	4	0
PR	Payment Request	2	1
PP	Project Photographs (including videotapes)	2	0
RD	Record Data	2	0
RFI	Request for Information	2	1
SAM	Sample	2	0
SD	Shop Drawings	3	1
SCH	Schedule of Progress	2	0

1.06 REVIEW PROCEDURES

A. Priority submittals will be reviewed before other submittals for this project which have been received but not reviewed.

1.07 REQUIREMENTS

A. Certifications. Warranties and Service Agreements include documents as specified in the detailed specifications. as shown in the submittal schedule or as follows:

1. Certified Test Reports (CTR) - A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the specifications.

2. Certification of Local Field Service (CLS) - A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300 mile radius of the project site. List names, addresses, and telephone numbers of approved service organizations on or attach to the certificate.

3. Extended Warranty (EW) - A guarantee of performance for the product or system beyond the normal one (1) year warranty described in the General Conditions, Issue the warranty certificate in the name of the Project Owner.

4. Extended Service Agreement (ESA) - A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period of time beyond the warranty period. Issue the service agreement in the name of the Project Owner.

5. Certification of Adequacy of Design (CAD) - A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product’s intended use.

6. Certification of Applicator/Subcontractor (CSQ) - A certified letter stating that the Applicator or Subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

B. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.

1. Provide record data for all products. Record data is not required for items

for which shop drawings and/or operations and maintenance manuals are required.

2. Provide information only on the specified products. Submit a Contractor's Modification Request for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting Record Data.

3. Record data will be received by the Engineer, logged, and provided to Owner for his/her record.

    a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings may be returned as unacceptable.

    b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

1.08 REQUESTS FOR DEVIATION

A. Submit requests for deviation from the Contract Documents for any product that does not fully comply with the specifications.

B. Submit request by Contractor's Modification Request (CMR) per Section 01040. PROJECT ADMINISTRATION. Identify the deviations and the reason the change is requested.

C. Deviations that result in a reduction in cost shall also include the amount of the reduction to the Owner.

D. A Change Order or Field Order will be issued by the Engineer for deviations approved by the Owner. Deviations from the Contract Documents may only be approved by Change Order or Field Order.

1.09 SUBMITTALS FOR SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.

B. If the Contractor desires to submit a manufacturer or product which is not specified, the Contractor must submit the following for consideration of approval of the substitution:

1. Contractor's Modification Request for deviation from the Contract Documents per Paragraph 1 .07.

2. Prove that the product is acceptable as a substitute. It is not the Engineers responsibility to prove the product is not acceptable as a substitute.

    a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.

    b. Make a direct comparison with the specified manufacturers published data sheets and available information. Provide this printed material with the submittal.

    c. The decision of the Engineer regarding the acceptability of the proposed substituted product is final.

3. Provide a typewritten certification that, in making the substitution request. The Contractor:

    a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.

    b. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.

    c. Will assume all responsibility to coordinate and modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional work which may be necessary to incorporate the substituted product into the project which may subsequently become apparent.

    d. Will maintain the same time schedule as for the specified product.

1.10 GUARANTEES

A. Warranties and guarantees shall be submitted as required by the Contract Documents and submitted with the shop drawings or record data.

1.11 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.

B. Need for more than one resubmission or any other delay of obtaining Engineer’s review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor’s expense.

1.12 ENGINEER'S DUTIES

A. Revise the submittals and return with reasonable promptness.

B. Affix stamp, indicate approval with or without comments, rejection, and the need for re-submittal.

C. Distribute documents.

SUBMITTAL SCHEDULE

Spec. No.	Description	SD	SAM	CTR	CLS	EW	ESA	CAD	CSQ	RD	OM	EIR	PPB
01568	Erosion and Sediment Control during Construction									X			
01600	Products							X				X	
01650	Starting Systems										X	X	
01700	Contract Closeout									X			
01730	Operations and Maintenance Manual										X		
02556	Water Transmission Lines and/or Pressure Sewer Lines	X								X			
02570	Sanitary Sewer	X								X			
02575	Paving Repair and Resurfacing									X			
02590	Polyurthane Protective Coating									X			
03300	Cast in Place Concrete									X			
09101	Construction Traffic Control									X			
02223	Trench Protection System									X			
02236	Embankment		X							X			
02601	Flex base		X	X						X			
02610	Prime Coat		X	X						X			
02612	HMAC		X	X						X			

SD - Shop Drawing
SAM - Sample
CTR - Certified Test Report
CLS - Certification of Local Field Service
EW - Extended Warrant
ESA - Extended Service Agreement
PPB - Process Performance Bond
CAD - Certificate of Adequacy of Design
CSQ- Certification of Applicator/ Subcontractor Qualifications
RD - Record Data
OM - Operation and Maintenance Manuals
EIR - Equipment Installation Report

END OF SECTION

SECTION 01310 PROJECT CONTROL SCHEDULE

PART 1 - SCHEDULE REQUIREMENTS PROGRESS SCHEDULE

The work specified in this section includes planning, scheduling and reporting required by the CONTRACTOR. It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the work are essential elements of this CONTRACT.

A. The Project Control Schedule (PCS) shall be prepared and maintained by the CONTRACTOR as described in this section.

B. The PCS shall be the CONTRACTOR'S working schedule and will be used by the CONTRACTOR to plan, organize, and execute the work, record and report actual performance and physical progress, and to show how the CONTRACTOR plans to complete all remaining work as of the beginning of each progress report period (data date).

C. In addition, the PCS shall provide the OWNER with a tool to monitor and follow the progress of all phases of the work. The PCS shall comply with the various limits imposed by the scope of the work, contractually specified milestones and completion dates included in the contract.

D. The PCS shall be a Critical Path Method (CPM) schedule, utilizing the Precedence Diagramming Method (PDM).

E. The PCS must clearly show the sequence and interdependence of activities required for complete performance of the work, beginning with the Contract Start Date (CSD) and concluding with the Contract Completion Date (CCD). The maximum duration of any physical work activity shall not exceed twenty (20) working days unless approved by the OWNER.

F. The CONTRACTOR shall use a scheduling system capable of handling, processing, printing and plotting data to satisfy all requirements of this section. The scheduling system must be capable of producing project reports and other digital (electronic) data that can be directly read and interpreted by the OWNER.

PART 2 - SUBMITTAL PROCEDURES

The OWNER will schedule and conduct a Preconstruction Conference. At this meeting, the requirements of this section, as they apply to the contract, will be reviewed with the CONTRACTOR. The CONTRACTOR shall be prepared to review and discuss

methodology for the schedule and sequence of operations and labor, equipment and material constraints.

A. PROJECT CONTROL SCHEDULE (PCS)(PRELIMINARY) - within fifteen (15) working days after the Preconstruction Conference, the CONTRACTOR shall submit to the OWNER the Preliminary Project Schedule (PPS), which shall be the basis of the PROJECT CONTROL SCHEDULE (BASELINE), and which will be used to schedule early activities of the project. The PPS shall include a detailed plan of operations for the first sixty (60) calendar days from the Contract Start Date.

   The PPS shall be a network diagram or bar chart, utilizing the CONTRACTOR'S WORK BREAKDOWN STRUCTURE showing in detail:

   1. Notice of Acceptance of Proposal.
   2. Pre-Construction Conference.
   3. Contract start date.
   4. Mobilization.
   5. Submission and approval of key submittals.
   6. Procurement of key materials and equipment.
   7. All activities occurring or starting within the first sixty (60) calendar days.
   8. Milestones and other contractual dates.
   9. Contract completion date.

B. Submittal and acceptance of the Preliminary Project Schedule is a condition precedent to the issuance of any initial payment.

C. PROJECT CONTROL SCHEDULE (BASELINE) - within sixty (60) calendar days of the CSD, the CONTRACTOR shall submit, for acceptance by the OWNER, the Project Control Schedule (Baseline). The PCS-Baseline shall represent the CONTRACTOR'S complete plan for the execution of the CONTRACT in accordance with the BID and CONTRACT documents. Although limited technical assistance is available to the CONTRACTOR from the OWNER upon written request and prior to any formal review and/or finalization of the baseline schedule, it is the responsibility of the CONTRACTOR to employ or engage the services of a technically qualified scheduler on this project.

D. PROJECT CONTROL SCHEDULE (UPDATES) - Once each month, or more often if deemed necessary by the OWNER, the CONTRACTOR shall review and update the PCS to incorporate all current information, including progress, approved adjustments of time and logic, and proposed changes in sequence and logic. All copies of the updated PCS submitted to the OWNER, shall be signed and dated by the CONTRACTOR.

E. PROJECT CONTROL SCHEDULE (AS-BUILT) - The last PCS update submitted shall be identified as the "As-Built Schedule", and is a condition precedent to issuance of Final Acceptance of the CONTRACT by the OWNER.

PART 3 - DEFINITIONS

The principles and definitions of the terms used herein shall be as set forth in the Associated General Contractors of America (AGC) publication "The Use of CPM in Construction," copyright 1976. Additional definitions are set forth as follows:

A. Critical Path(s) - shall be defined as the longest path of activities from the Contract Start Date (CSD) to the Contract Completion Date (CCD).

B. Near Critical Path - shall be defined as those paths of activities having a total float value equal to the total float value of the defined critical path (longest path) plus ten (10) working days.

C. Activity Codes - are values assigned to schedule activities to organize the Schedule Activities into manageable groups for updating, analyzing, reporting, plotting, and summarizing.

D. WBS - (Work Breakdown Structure) is a definition of project related activity codes, to be used by the CONTRACTOR to organize the CONTRACTOR'S Project Control Schedule in a manner that facilitates the OWNER'S use of the PCS information.

E. Constraint - is a restriction imposed on the start, finish or duration of an activity. Project Control Schedule

F. Data Date - (DD) The date used as the starting point for schedule calculations. For Baselines, the DD is the first day of the project, the CSD date. For subsequent schedule updates, the DD is the first workday of the remainder of the schedule, normally the first calendar day after the schedule close-out date (usually month end).

G. Total Float - is the amount of time that the start or finish of an activity can be delayed without impacting the Contract Completion Date. Total float is a CALCULATED value.

H. Free Float - is the amount of time that the start or finish of an activity can be delayed without impacting the early start or finish of a successor activity. Free float is a CALCULATED value.

I. Lag - is an offset or delay from an activity to its' successor, or from its' predecessor. Lag is physically defined by the scheduler. Lag is NOT CALCULATED.

J. Open End - is an activity that has either no predecessor or no successor relationships.

K. Out of Sequence Progress - means that all or a portion of an activity has been completed before the predecessors to the activity are complete.

L. Percent Complete - the portion of an activity that is complete based on physical measurement of the scope of work included in the activity that has been completed by the CONTRACTOR and accepted by the OWNER.

M. Target (Baseline) - a different version of the project schedule that can be compared to as the basis for measuring differences between the versions of the project schedule.

PART 4 - PROJECT CONTROL SCHEDULE (BASELINE)

The CONTRACTOR shall be responsible for assuring that all work sequences are logical and the network shows a coordinated plan for the complete performance of the CONTRACT. Failure of the CONTRACTOR to include any element of the work required for the performance of the CONTRACT in the network shall not relieve the CONTRACTOR from completing all work within the time specified for the completion of the CONTRACT. In the event the CONTRACTOR fails to define any element of the work in the network, when the omission or error is discovered by either the CONTRACTOR or OWNER, it shall be corrected by the CONTRACTOR at the next scheduled update or submittal.

A. The PCS Baseline shall be organized to clearly define separate groups of activities detailing:

1. key submittals,

2. procurement of major materials and equipment,

3. delivery of OWNER furnished materials and equipment,

4. approvals required by regulatory agencies or other third parties,

5. plans for all major subcontract work,

6. access to and availability of all work areas,

7. identification of interfaces and dependencies with preceding, concurrent, and follow-on contractors,

8. tests and inspections,

9. identification of any manpower, material or equipment restrictions.

B. Relationships shall be defined between the CONTRACTOR'S activities based on the following criteria.

PHYSICAL - relationships occur when a successor activity cannot physically start (or finish) until a predecessor activity completes (or starts). ***example: forming before pouring***

SAFETY - defined relationships exist when a successor activity cannot start until a predecessor activity (which may be creating a safety hazard for the successor activity), completes allowing for the start of the successor in a safe environment. ***example: completing overhead work before starting work underneath***

RESOURCE - driven relationships occur when a successor activity cannot start until a predecessor activity completes and releases its' resources to work on the successor. ***example: form slab # 1 before forming slab # 2 when allocating one crew to a job***

PREFERENTIAL - logic occurs when a contractor prefers to perform the work in a given sequence. ***example: completing painting before starting finished flooring***

NOTE: The basis of Safety, Resource and Preferential logic requirements for all critical or near critical activities shall be documented in the Baseline Schedule Narrative or as requested by the OWNER.

C. The basis of constraints and lags utilized in the PCS-BASELINE and subsequent UPDATES must be documented in an accompanying schedule narrative.

D. The CONTRACTOR shall not utilize float suppression techniques or artificial restraints, constraints, lags or durations to lessen or control the amount of total or free float contained in the network.

E. Float shall not be considered as time for the exclusive use of or benefit of either the OWNER or the CONTRACTOR. Float shall be considered as a resource available to both parties for the benefit of the project.

F. Early Completion - An early completion schedule is one which anticipates completion of the work ahead of the corresponding Contract Time. Since Total Float is measured to the Contract Completion Date (CCD), and belongs to the Project, the CONTRACTOR shall not be entitled to any extension in Contract Time, or recovery for any delay incurred because of extensions in an early completion date, until all total float is used or consumed and performance or completion of the WORK extends beyond the corresponding Contract Time.

G. Project Schedule Reports shall be submitted to the OWNER as follows:

Graphics - 11" x 17" (Tabloid)

1. Time Scaled Logic Diagram based on early dates, organized by OWNERWBS Codes with the longest (critical) path printed in red. (Attachment A.)

2. Bar chart, organized by CONTRACTOR-WBS, indicating early and late date bars with critical path printed in red.

Graphics – 8½" x 11" (A size)

3. Detailed Bar Chart, Grouped by CONTRACTOR-WBS

4. Estimated Cash Flow Histogram (if cost loaded) with planned value per period (bar) and cumulative to date (curve).

Tabular Reports – 8½" x 11" (A size)

5. Predecessor / Successor listing including relationship type and lag value, organized by Activity ID.

6. Tabular activity listing, sorted by Activity ID, with Early and Late Dates, Total and Free Float values.

7. Tabular activity listing, Grouped by Responsible party, sorted by Early Start, with Early Dates, Total and Free Float values.

8. Listing of all schedule constraints and open ends with explanation of each.

9. Identification of all lags contained in relationships and explanation of each.

10. Narrative report explaining the key "basis and assumptions" of the Project Control Schedule Baseline schedule.

11. Submittal / Procurement Status Report - A P3 Activity Matrix Report detailing for each submittal item, the Planned Dates for each step in the submittal/ procurement process.

12. Bid Item Listing.

H. Submittal

1. Six (6) sets of all graphics

2. Six (6) sets of all tabular reports

I. Acceptance

1. The OWNER may accept the PCS-Baseline submittal and subsequent updates as having been submitted in accordance with the Contract Specifications. The OWNER will review and make comments on the PCS. Meetings may be held between the OWNER and the CONTRACTOR, and all SUBCONTRACTORS and SUPPLIERS whom the CONTRACTOR may desire to invite or whom the OWNER may request be present.

2. The PCS submittal must meet in all respects the time and order of work requirements of the contract. The work shall be executed in the sequence indicated in the accepted baseline and subsequent accepted updates and revisions. If the CONTRACTOR changes the sequence of work, a baseline revision submittal will be required in accordance with Section 4.10.

3. Comments made by the OWNER on the PCS or any subsequent updates and revisions, will not relieve the CONTRACTOR from compliance with requirements of the Contract Documents.

4. If requested by the OWNER at any time during the project, the CONTRACTOR shall provide detailed, short term schedules for specific items of the work.

J. Baseline Schedule Revisions

1. No change shall be made to the accepted Project Control Schedule Baseline without the prior written authorization of the OWNER.

2. If the CONTRACTOR desires or the OWNER requests that the PCS Baseline be revised to reflect specific ISSUES of the current project plan, the CONTRACTOR shall prepare a detailed analysis of the time related impacts of the specific ISSUE, demonstrating how the CONTRACTOR proposes to incorporate the ISSUE into the PCS Baseline.

3. Each time impact analysis shall be submitted prior to approval of any change in the contract to facilitate the incorporation of the impact in the next schedule submittal by the CONTRACTOR.

4. Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the remaining total float along the path of activities impacted by the ISSUE.

5. When an authorized revision is made to the PCS Baseline, the revised baseline shall be identified by a Revision Number, giving the revised Baseline a distinct identification separate from all previous or subsequent Baseline Revisions.

K. Schedule Updates

1. The CONTRACTOR shall submit the Project Control Schedule - Update to the OWNER each month, on a date assigned by the OWNER. The Update submittal shall include all information available up to the Data Date established by the OWNER.

2. The PCS-Update submittal shall be reviewed jointly (if necessary) with the OWNER for the purpose of verifying update information. The OWNER may request key SUBCONTRACTORS or SUPPLIERS to participate in the review with the CONTRACTOR. Information to verify includes but is not limited to:

a) Actual start / finish dates for activities started or finished in the current period.

b) Activity Percent Complete for activities that are currently in progress.

c) Remaining durations or expected finish dates for activities that are currently in progress.

d) Revised logic (as-built and projected) and changes in activity durations.

e) Impacts of Issues identified by the CONTRACTOR or OWNER.

f) Incorporation of OWNER approved time extensions.

3. The CONTRACTOR may not make changes to any actual events previously entered in prior updates without written concurrence by the OWNER.

4. PCS-Update submittals shall be prepared as follows:

Graphics - 11" x 17" (Tabloid size)

a) Time scaled Logic Diagram of early dates, organized by WBS Codes with the calculated critical path printed in red.

b) Bar chart, organized by WBS Codes, indicating early and late dates with critical path printed in red, with Target (Baseline) Bar.

Graphics - 8½” x 11" (A size)

c) Detailed Bar Chart , Grouped by OWNER-WBS, with Target (Baseline) Bar.

Tabular Reports - 8½" x 11" (A size)

d) Tabular activity listing, sorted by Activity ID, with Early and Late Dates, with Total and Free Float values.

e) Tabular activity listing, sorted by Early Start, with Current Early and Current Baseline dates and Variance between Current Early and Current Baseline Finish Dates.

f) Tabular activity listing, Grouped by Responsible party, sorted by Early Start, with Early Dates, Total and Free Float values.

g) Listing of any NEW or DELETED schedule constraints and open ends with explanation of each.

h) Identification of all NEW or DELETED lags contained in relationships and explanation of each.

i) Identification of all NEW or DELETED activities and an explanation of each.

j) Narrative report including description of problem areas, current and anticipated delaying factors, and their expected impact, and an explanation of current actions taken or proposed. In addition, alternative for possible schedule recovery to mitigate any potential delay and/or cost

increases should be included in the monthly narrative by the CONTRACTOR.

k) Submittal/Procurement Status Report.

l) Bid Item Listing Report.

m) If the CONTRACTOR fails to submit any of the PCS update submittal deliverables, the OWNER may withhold approval of progress payment estimates until such time as the CONTRACTOR submits the required update submittal.

PART 5 - PAYMENT FOR PROJECT CONTROL SCHEDULE

A. Project Control Schedule will be considered incidental to the cost of the overall project. There shall be no separate pay for the Project Schedule.

END OF SECTION

SECTION 01411 ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

The contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

A. SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

B. PERMITS

The Contractor shall obtain all needed permits or licenses. The Owner will not obtain any permits for this project. The Environmental Protection Agency (EPA), through the national pollutant discharge elimination system (NPDES), requires general permits, a notice of intent, and a notice of discontinuation. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

C. PRECONSTRUCTION SURVEY

Prior to starting any onsite construction activities, the Contractor and Owner shall make a joint condition survey, after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed areas immediately adjacent to work sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the owner and the Contractor upon mutual agreement as to its accuracy and completeness.

D. MEETINGS

The Contractor shall meet with representatives of the Owner to change the environmental protection plan as needed for compliance with the environmental pollution control program.

E. NOTIFICATION

The Owner will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Owner of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

F. PREVIOUSLY USED EQUIPMENT

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed.

G. PAYMENT

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

1.02 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut , deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use in permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

A. WORK AREA LIMITS

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during

darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

B. LANDSCAPE

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Fencing shall be erected at sufficient distance from a tree trunk (usually equal to the diameter of the tree crown) to prevent compaction of soil over the root spread.

C. UNPROTECTED ERODIBLE SOILS

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Owner.

D. DISTURBED AREAS

The Contractor shall effectively prevent erosion and control sedimentation through approved methods and Best Management Practices (BMP's) including, but not limited to, the following:

1. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.

2. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

3. Sediment basins. Sediment from construction areas maybe trapped in temporary or permanent sediment basins in accordance with the drawings. The basins shall accommodate the runoff of a local 5 year storm (6.1" in 24 hours). After each storm, the basins shall be pumped dry and accumulated sediment shall be removed to maintain basin effectiveness. Overflow shall be controlled by paved weirs or by vertical overflow pipes. The collected

topsoil sediment shall be reused for fill on the construction site, and/or stockpiled for use at another site. The Contractor shall institute effluent quality monitoring programs as requested by State and local environmental agencies.

4. De-watering of site and control of water quality. All water discharged from any excavation will be deposited at approved locations only. The Contractor will monitor water quality and not dispose of any material illegally. De-watering methods will be included in the Contractor's SWPPP.

E. CONTRACTOR FACILITIES AND WORK AREAS

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Owner. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plan and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.03 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

A. WASHING AND CURING WATER

Waste waters directly derived from construction activities shall not be allowed to enter stormwater or wastewater facilities.

B. FISH AND WILDLIFE

The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife.

1.04 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with the State of Texas rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality, if required, shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Owner to ensure compliance.

A. PARTICULATES

Dust particles, aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor mush have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

B. HYDROCARBONS AND CARBON MONOXIDE

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

C. ODORS

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

D. SOUND INTRUSIONS

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the City ordinances.

1.05 WASTE DISPOSAL

Disposal of wastes shall comply with all applicable City requirements and as specified below.

A. SOLID WASTES

Solid wastes (excluding clearing debris) shall be placed in containers and emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. Contractor shall dispose of classified non-hazardous solid waste at disposal area. The Contractor shall comply with Federal, State, and local laws and regulations pertaining to the use of landfill areas.

B. HAZARDOUS WASTES

The Contractor shall take sufficient measures to prevent spillage of hazardous materials during dispensing and collect waste in suitable containers observing compatibility. Toxic materials shall not be used within the construction site. The Contractor shall immediately transport hazardous waste and dispose of it in compliance with Federal and local laws and regulations. Storage of hazardous waste on the construction site is prohibited. Spills of hazardous materials shall be immediately reported to the Owner. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

C. BURNING

Burning will not be allowed.

1.06 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Owner, if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Owner. While waiting for instructions the Contractor shall record, report, and preserve the finds

in accordance with the requirements of the Texas State Historical Preservation Office.

1.07 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.08 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas at no costs to the OWNER.

1.09 MAINTENANCE OF ANTI-POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 01460

LABORATORY TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This item shall consist of all required testing and inspection services required to provide certification that the completed construction is in substantial compliance with the contract, plans and specifications.

B. Testing and inspections shall include: all underground utilities (water, sewer & drainage), roadway embankment, subgrade, base & asphalt, curbs of all types, concrete pavements, concrete structures, signage, striping, and all other facilities as may be included in the overall scope of construction.

C. Inspections may include observations to determine compliance with the prescribed stormwater pollution prevention plan (SW3P), trench safety, personal protection equipment and traffic control plans.

D. The ENGINEER has the authority to observe, test, inspect, approve, and accept the work. The ENGINEER decides all questions about the quality and acceptability of materials, work performed, work progress, Contract interpretations, and acceptable Contract fulfillment. The ENGINEER has the authority to enforce and make effective these decisions.

E. The ENGINEER acts as a referee in all questions arising under the terms of the Contract. The ENGINEER's decisions will be final and binding.

PART 2 – PRODUCTS (not used)

PART 3 - EXECUTION

3.01 LABORATORY TESTING

A. All required laboratory testing shall be completed by an independent, qualified testing laboratory approved by the CITY. All initial testing shall be paid for by the CITY. Any retesting required shall be paid for by the CONTRACTOR.

B. Cost for additional review time will be billed to the CONTRACTOR by the OWNER for the actual hours required for the re-testing in accordance with the current rates as established by the contract between the CITY and the Testing Lab. Cost for the additional review shall be paid to the OWNER by the CONTRACTOR on a monthly basis.

3.02 INSPECTIONS

A. PROVIDERS: All required inspections shall be provided by either the independent testing laboratory or by the ECISD Engineering department staff. All initial inspections conducted during normal business hours (8:00 am to 5:00 pm, Monday – Friday, excluding Holidays) shall be provided by the CITY at no charge. Any inspections or testing requested by the CONTRACTOR to be provided at any other time will be paid for by the CONTRACTOR. Any re-inspections or re-testing required shall be paid for by the CONTRACTOR.

B. COSTS: Cost for additional review time will be billed to the CONTRACTOR by the OWNER for the actual hours required for the retesting in accordance with the current rates as established by the contract between the CITY and the Testing Lab. Cost for the additional review shall be paid to the Owner by the CONTRACTOR on a monthly basis.

C. INSPECTORS: Inspectors are authorized representatives of the ENGINEER. Inspectors are authorized to examine all work performed and materials furnished, including preparation, fabrication, and material manufacture. Inspectors inform the CONTRACTOR of failures to meet Contract requirements. Inspectors may reject work or materials and may suspend work until any issues can be referred to and decided by the ENGINEER. Inspectors cannot alter, add, or waive Contract provisions, issue instructions contrary to the Contract, act as foremen for the CONTRACTOR, or interfere with the management of the work. Inspection or lack of inspection will not relieve the CONTRACTOR from obligation to provide materials or perform the work in accordance with the Contract. CONTRACTOR shall provide safe access to all parts of the work and provide information and assistance to the ENGINEER to allow a complete and detailed inspection and give the ENGINEER sufficient notice to inspect the work. Work performed without suitable inspection, as determined by the ENGINEER, may be ordered removed and replaced at CONTRACTOR's expense. CONTRACTOR shall remove or uncover portions of finished work as directed. Once inspected, restore work to Contract requirements. If the uncovered work is acceptable, the costs to uncover, remove, and replace or make good the parts removed will be paid for in accordance "Changes in the Work." If the work is unacceptable, CONTRACTOR shall assume all costs associated with repair or replacement, including the costs to uncover, remove, and replace or make good the parts removed. When a government entity, utility, railroad company, or other entity accepts or pays a portion of the Contract, that organization's representatives may inspect the work but cannot direct the CONTRACTOR. The right of inspection does not make that entity a party to the Contract and does not interfere with the rights of the parties to the Contract.

D. FINAL INSPECTION: After all work is complete, the CONTRACTOR will

request a final inspection by the ENGINEER authorized to accept the work. The final inspection will be made as soon as possible, and not later than 10 calendar days after the request. No working day charges will be made between the date of request and final inspection. After the final inspection, if the work is satisfactory, the ENGINEER will notify the CONTRACTOR in writing of the final acceptance of the work. If the final inspection finds any work to be unsatisfactory, the ENGINEER will identify in writing all deficiencies in the work requiring correction. Correct the deficiencies identified. Working day charges will resume if these deficiencies are not corrected within 7 calendar days, unless otherwise authorized by the ENGINEER. Upon correction, the ENGINEER will make an inspection to verify that all deficiencies were corrected satisfactorily. The ENGINEER will provide written notice of the final acceptance.

3.03 SCHEDULING

A. It shall be the CONTRACTOR'S responsibility to contact either the testing lab or the Owner at least 48 hours before the required testing or inspection is to occur.

B. It shall be the CONTRACTOR'S responsibility to plan the construction in such a manner to allow the appropriate tests and inspections to be conducted without disruption to the construction process.

3.04 PREPARATION

A. CONTRACTOR shall be responsible for preparing the project site as necessary to conduct all required testing. This shall include, but may not be limited to: proper grading of construction site, completion of required compaction activities, complete installation of all forms, installation of all required reference points (grade stakes), provision of adequate traffic control, additional personnel and/or supplies and all necessary safety measures (i.e. OSHA compliant Trench Safety) as needed.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. This work shall be considered incidental to the completion of the project and no additional compensation shall be paid for this work.

4.02 PAYMENT

A. No separate payment shall be made for this item.

END OF SECTION

SECTION 01568 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment and incidentals necessary to provide erosion and sediment control for the duration of the construction period including furnishing, installing and maintaining erosion and sediment control structures and procedures and the proper removal when no longer required.

The intent of this specification is to provide guidelines for the Contractor to adhere to all State, Federal, and Local environmental regulations. It is also the intent to provide preventive measures to keep sediment from entering any storm water system, including open channels. It is the Contractor's responsibility to adhere to all State, Federal and Local requirements. While the Owner may require the Contractor to install erosion control devices during construction, this will in no way relieve the Contractor of his responsibility.

1.02 QUALITY ASSURANCE

A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Plans are not represented as being comprehensive, but rather to convey the intent to provide complete slope protection and erosion control for both the Owner's and adjacent property.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire length of construction. On-site areas which are subject to severe erosion and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive additional erosion control measures as directed by the Owner or the Engineer.

C. All land-disturbing activities shall be planned and conducted to minimize the size of the area to be exposed at any one time and to minimize the time of exposure.

D. Surface water runoff originating upgrade of exposed area shall be controlled to reduce erosion and sediment loss during the period of exposure.

E. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving ditch or stream, the Contractor shall install measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream as directed by the Owner or the Engineer.

F. All land-disturbing activities shall be planned and conducted so as to minimize off-site sedimentation damage.

C. The Contractor shall be responsible for periodically cleaning out and disposing of all sediment once the storage capacity of the drainage feature or structure receiving the sediment is reduced by one-half. The Contractor shall also be responsible for cleaning out and disposing of all sediment at the time of completion of the Work.

1.03 SUBMITTALS

Submittals shall be in accordance with Section 01300, SUBMITTALS, and shall include:

A. Manufacturer's Literature: Descriptive data of installation methods and procedures.

B. Certificates: Manufacturer's certification that materials meet specification requirements.

1.04 JOB CONDITIONS AND ORDINANCES

Comply with the local ordinances. If local ordinances require *more* stringent or additional erosion and sediment control measures during construction, Contractor shall provide such measures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. STRAW BALES: Straw bales shall weigh a minimum of fifty (50) pounds and shall be at least 30" in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string. Jute or cotton binding is unacceptable. Bales shall be used for not more than three months before being replaced. However, if weather conditions cause biological degradation of the straw bales, they shall be replaced sooner than the three month time period to prevent a loss of structural integrity of the dike.

B. SILT FENCE: Silt fence fabric shall be a nylon reinforced polypropylene fabric which has a built-in cord running the entire length of the top edge of the fabric. The fabric must meet the following minimum criteria:

Tensile Strength, ASTM D4632	90 lbs.
Puncture Rating, ASTM D4833	60 lbs.
Mullen Burst Rating, ASTM D3786	200 psi.
Apparent Opening Size, U.S. Sieve No.	40

Silt fence shall be “Enviro Fence” preassembled silt fence, AMXCO Silt Stop prefabricated silt fence, AMOCO Style 2155 preassembled silt fence or approved equal.

C. SILT FENCE POSTS: A minimum 2” x 2” (nominal) x 54” pressure treated wood posts of Number 2 Grade southern yellow pine or approved equal.

D. SAND BAG: Sand bag material shall be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight four (4) ounces per square yard, mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70%. Length shall be 24 to 30 inches, width shall be l6 to 18 inches and thickness shall be six (6) to eight (8) inches and having an approximate weight of 40 pounds. Sand bags shall be filled with coarse grade sand, free from deleterious material. All sand shall pass through a No. 10 sieve.

E. P.V.C. PIPE: Pipe shall be SDR-35 polyvinyl chloride having a minimum nominal internal diameter of 4”. Pipes shall be sized for anticipated flows.

F. SOIL RETENTION BLANKET: Soil retention blankets shall consist of a geocomposite of excelsior or fiber blanket with an extruded plastic net attached to the top side. The plastic net shall be photodegradable and the excelsior or fiber blanket shall be made smolder resistant without the use of chemicals. Soil retention blankets shall be high velocity type to resist severe runoff. The soil retention blanket shall be one (1) of the following classes and types:

1. Class 1. “Slope Protection”

   (a) Type A. Slopes of 3:1 or flatter-Clay soils

   (b) Type B. Slopes of 3:1 or flatter - Sandy soils

   (c) Type C. Slopes steeper than 3:1 - Clay soils

   (d) Type D. Slopes steeper than 3:1 - Sandy soils

2. Class 2. “Flexible Channel Liner”

   (a) Type E. Short-term duration (Up to 2 Years)
   Shear Stress (t_d) <1.0 lb./sq. ft.

   (b) Type F. Short-term duration (Up to 2 Years)
   Shear Stress (t_d) 1.0 to 2.0 lb./sq. ft.

   (c) Type C. Long-term duration (Longer than 2 Years)

Shear Stress (t_d)> 2.0 to < 5.0 lb./sq. ft.

(d) Type H. Long-term duration (Longer than 2 Years)
Shear Stress (t_d) greater than 0 Equal to 5.0 lb/sq. ft.

The Contractor has the option of selecting an approved soil retention blanket provided that selection conforms to the following list of approved soil retention blankets for slope protection applications:

CLASS I. SLOPE PROTECTION

TYPE A: Slopes of 3: I or Flatter- Clay Soils

Airtrol® ANTI-WASH®/GEOJUTE® (Regular)
Contech Standards®
Contech Standards Plus®
Green Triangle Regular®
Green Triangle Superior®
GREENSTREAK® PEC MAT
Curlex®
North American Green® S150
North American Green® S75
North American Green® SC 150
POLYJUTEÔ 4O7/GT
SOIL SAVER®
TerraJute®
Verdyol® ERO-MAT®
Xcel Regular®
Xcel Superior®

TYPE B: Slopes of 3:1 or Flatter-Sandy Soils

Contech Standards®
Contech Standards Plus®
GEOCOIR®/DEKOWE® 700
Green Triangle Superior®
Green Triangle Regular®
North American Green® 575
North American Green® SC 150
North American Green® S150
POLYJUTEO 407/CT
TerraJute®
Verdyol® ERO-MAT®
XceI Superior®
XceI Regular®

TYPE C: Slopes Steeper than 3:1-Clay Soils

Airtrol®
ANTI-WASH®/GEOJUTE® (Regular)
Contech Standards Plus®
Curlex®
Green Triangle Superior®
GREENSTREAK® PEC-MAT
North American Green® SC 150
North American Green® S150
POLYJUTEÔ 407/CT
SOIL SAVER®
TerraJute®
Xcel Superior®

TYPE D: Slopes Steeper than 3:1-Sandy Soils

Contech Standards Plus®
GEOCOIR®/DEKOWE®700
Green Triangle Superior®
North American Green®S150
North American Green®SC150
POLYJUTEÔ 407GT
TerraJute®
Xcel Superior®

CLASS II: FLEXIBLE CHANNEL LINER PROTECTION

PART 3 - EXECUTION

3.01 PREPARATION

A. Contractor shall prepare the site for installation of the erosion and sediment control devices in accordance with the manufacturer's recommendations when applicable. At all times, CONTRACTOR, shall take extreme care during the installation of the applicable devices to minimize disturbance of the project site.

3.02 INSTALLATION

A. TEMPORARY STRAW BALE DIKE

1. Straw bales shall be embedded a minimum of 4" and securely anchored using 2" x 2" wood stakes driven through the bales into the ground a minimum of 6" Straw bales are to be placed directly adjacent to one another leaving no gap between them.

2. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale. Additional bales shall be placed behind the first row where the bales abut each other. The additional bale is used to prevent unfiltered runoff from escaping between the bales.

3. The-excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4" above ground level on the uphill side. Loose straw shall be scattered over the area immediately uphill from a straw barrier.

B. SILT FENCE

The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas to a limited extent. The Contractor shall excavate a 6 inch wide by 6 inch deep trench for site fence bedding along the lower perimeters of the site where necessary to prevent sediment from entering any drainage system. The Contractor shall install the silt fence in accordance with the manufacturer's recommendations and instructions. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence shall remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way or where soil conditions prevent a minimum toe-in depth of 6" or installation of support post to depth of 12". Fabric shall overlap at abutting ends a minimum of 3' and shall be jointed such that no leakage or bypass occurs. If concentrated flow occurs after installation, corrective action must be taken such as placing rock berm in the areas of concentrated flow.

C. SAND BAG BERM

1. The purpose of a sandbag berm is to intercept sediment-laden water from disturbed areas such as construction in steam beds, create a retention pond, detain sediment and release water in sheet flow.

2. A temporary sand bag berm shall be installed across a channel or right of way in a developing or disturbed area and should be used when the contributing drainage area is greater than 5 acres. The berm shall be a minimum height of 18", measured from the top of the existing ground at the upslope toe to the top of the berm. The berm shall be sized to have a minimum width of 48" measured at the bottom of the berm and 18" measured at the top of the berm.

3. The sand bag berm shall be inspected after each rain. The sand bags shall be reshaped or replaced as needed during inspection. Additional inspections shall be made daily by the responsible party and when the silt reaches 6", the accumulated silt shall be removed and disposed of at an approved site in a manner that will not contribute to additional siltation. The sand bag berm shall be left in place until all upstream areas are stabilized and accumulated silt removed; removal must be done by hand.

D. SOIL RETENTION BLANKETS

1. A soil retention blanket (SRB) is a geotextile or biodegradable fabric placed over disturbed areas to limit the effects of erosion due to rainfall impact and runoff across barren soil. Soil retention blankets are manufactured by a wide variety of vendors addressing a wide variety of conditions such as vegetation establishment and high velocity flow. Blankets are used in areas which are difficult to stabilize such as steep slopes, drainage swales or high pedestrian traffic areas.

2. The soil retention blanket, whether installed as slope protection or as flexible channel liner, shall be placed within 24 hours after seeding or sodding operations have been completed, or as approved by the Engineer. Prior to placing the blanket, the area to be covered shall be relatively free of all rocks or clods over 1-1/2" in maximum dimension and all sticks or other foreign material which will prevent the close contact of the blanket with the soil. The area shall be smooth and free of ruts and other depressions. If as a result of rain, the prepared bed becomes crusted or eroded or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's expense.

3. Installation and anchorage of the soil retention blanket shall be in accordance with the manufacturer's recommendations.

E. PROTECTION OF BARE AREAS

1. Apply seeding and soil retention blanket to bare areas including new embankment areas, fills, stripped areas, graded areas or otherwise disturbed areas, which have a grade greater than *5%* or which will be exposed for more than 30 days.

2. Bare working areas on which it is not practical or desirable to install seeding and soil retention blankets, as determined by the Engineer, such as areas under proposed building slabs, shall be temporarily sloped to drain at a minimum of 0.2% and a maximum of 5% grade. These areas shall then be "track walked" with a crawler dozer traveling up and down the slope to form the effect of small "terraces" with the tracks of the dozer.

Apply a minimum of three (3) coverages to each area with the dozer tracks,

3. Route runoff from the areas through the appropriate silt fence system.

4. Protect earth spoil areas by “trackwalking” and silt fences.

F. INTERCEPTOR SWALE

1. Interceptor swales may have a v-shape or be trapezoidal with a flat bottom and side slopes of 3:1 or flatter. These are used to shorten the length of exposed slope by intercepting runoff and can also serve as perimeter swales preventing off-site runoff from entering the disturbed area or prevent sediment-laden runoff from leaving the construction site or disturbed area. The outflow from a swale must be directed to a stabilized outlet or sediment trapping device. The swales should remain in place until the disturbed area is permanently stabilized.

2. Stone Stabilization shall be used when grades exceed 2% or velocities exceed 6 feet per second and shall consist of a layer of crushed stone *3”* thick, or flexible channel liner soil retention blankets. Stabilization shall extend across the bottom of the swale and up both sides of the channel to minimum height of 6 inches above the design water surface elevation based on a two year storm.

3. An interceptor swale shall be installed across exposed slopes during construction and should intercept no more than five *(5)* acres of runoff. Swales shall have a minimum bottom width of 2’-0” and a maximum depth of 1’-6” with side slopes of 3 :1 or flatter. Swale must have positive drainage for its entire length to an outlet. When the slope exceeds 3%, or velocities exceed 4 feet per second (regardless of slope), stone stabilization is required. Check dams are also recommended to reduce velocities in the swales possibly reducing the amount of stabilization necessary. Swales should be inspected on a weekly basis during wet weather and repairs should be made promptly to maintain a consistent cross section.

4. All trees, brush, stumps, obstructions and other material shall be removed and disposed of so as not to interfere with the proper functioning of the swale.

5. The swale shall be excavated or shaped to line, grade, and cross-section as required to meet criteria specified herein and be free of bank projections or other irregularities which will impede normal flow.

6. All earth removed and not needed in construction shall be disposed of in

an approved spoils site so that it will be conveyed to a sediment trapping device.

7. Diverted runoff from a disturbed or exposed upland area shall be conveyed to a sediment trapping device.

8. The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.

9. Minimum compaction for the swale shall be 90% standard proctor.

G. LOCATION OF EROSION AND SEDIMENT CONTROL STRUCTURES

1. Locate erosion and sediment control structures as required to prevent erosion and removal of sediment from the project site. Silt fences shall be required for disturbed areas and soil stockpiles/spoil areas. Each silt fence installation shall have a minimum net length (exclusive of embedments into diversion dikes or other ineffective areas) of 25 feet. The runoff from a maximum of one (1) acre of disturbed area or soil stockpile/ spoil area shall be routed through any individual silt fence installation.

2. Install diversion dikes to divert runoff to the silt fence installation.

3. Install silt traps at the inlet (upstream) end of the drainage structures, including open channels, through which runoff from disturbed areas or soil stockpiles/spoil areas may drain.

4. Provide an overall erosion and sediment control system which protects disturbed areas and soil stockpiles/spoil areas. The system shall be modified by the Contractor from time to time to effectively control erosion and sediment during construction.

3.03 MAINTENANCE

A. Maintain erosion and sediment control structures and procedures in full working order at all times during construction. This shall include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment on a regular basis which accumulates in sediment control devices and place the material in approved earth spoil areas or return the material to the area from which it eroded.

B. Upon completion of construction, properly remove the temporary erosion and sediment control structures and complete the area as indicated.

C. Soil retention blankets will not require removal if installed on a finished graded area specified to receive seeding.

3.04 FIELD QUALITY CONTROL

In the event of conflict between the requirements and storm water pollution control laws, rules or regulations or other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

The work as provided for by this specification shall be measured as lump sum or as noted on the bid request. When not line item is included in the Bid Proposal, this work shall be considered incidental to the completion of the project and no additional compensation shall be paid for this work.

4.02 PAYMENT

When shown in the proposal, the work as prescribed for in this specification shall be paid for labor, tools, equipment, excavation, backfilling, materials, and incidentals necessary to complete the work.

END OF SECTION

SECTION 01700 – PROJECT CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK AND RELATED DOCUMENTS

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation and services required and incidental thereto, as shown on drawings and/or specified herein including but not limited to; the submittal of closeout documents, final cleaning of materials and equipment and furnishing permit clearances, guarantees and warranties.

B. Related Work Specified Elsewhere:

1. Submittal Requirements: Section 01300

C. The completion of the closeout procedures indicated in these specifications will be a condition for releasing final payment.

1.2 PROJECT CLEAN-UP

A. Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness. Use only materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material, or as approved by the Engineer/Architect.

B. Final cleaning shall mean a level of cleanliness generally provided by skilled cleaners using commercial quality, site maintenance equipment and materials.

C. The Contractor shall schedule a final cleaning as approved by the Engineer/Architect.

D. The contractor shall restore any disturbed areas or structures to pre-construction conditions or improved conditions.

1.3 ONSITE TRAINING

A. The Contractor shall provide a demonstration of the operation techniques and methods of the mechanical, electrical and plumbing systems. This demonstration must be coordinated with the Engineer/Architect. The operation and maintenance manuals must be available for use during this training period.

B. The Contractor shall propose a time in writing to the Engineer/Architect allowing at least seventy-two (72) hours notice.

1.4 AS BUILT DRAWINGS

A. Final "As-Built" drawings shall be prepared by the Contractor in an Auto CAD 2005, Microstation or better format. These drawings shall indicate all changes or deviations from the construction documents. These drawings shall be submitted to the Engineer/Architect on a CD. The drawings must clearly state AS BUILT and be neatly organized.

1.5 GUARANTEES AND WARRANTIES

A. The Contractor shall provide a construction warranty letter.

B. The Contractor shall provide final clearances from all permitting agencies.

1.6 FINAL COMPLETION

A. The Contractor shall supply a written request for a Final Completion inspection. This request shall include the following:

1. Certification that the work and actions specified in the Contract Documents has been completed and that the Owner has full use of the site.

2. All equipment has been tested and balanced and is fully functional.

3. The Onsite Training Program has been completed and there are no outstanding issues resulting from said program.

4. A copy of the list of deficiencies generated by the Substantial Completion Inspection, with each item initialed and showing date completed.

5. A list of all Subcontractors and material suppliers with name, address and phone number. Include source for parts replacement and local representative if different.

6. Submit all test/adjust/balance records and start-up performance reports.

7. Submit all tools, keys and any special devices to assure complete operation by the Owner.

8. Final application for payment.

9. Waivers, Sworn Statements and Affidavits of Payments to Subcontractors and Suppliers.

END OF SECTION

SECTION 02101 PREPARATION OF RIGHT-OF-WAY

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. Removal and disposal of all obstructions from the right-of-way and from designated easements for construction operations, by removing and disposing of all obstructions when removal of such obstructions is not specifically shown on the plans to be paid by other items.

B. Obstructions shall include, but are not limited to:

1. Remains of houses not completely removed by others.

2. Concrete, foundations, floor slabs, curb and gutter, driveways, and sidewalk.

3. Building materials such as brick, lumber and plaster.

4. Water wells, septic tanks, manholes, inlets utility pipes and conduits.

5. Underground service station tanks, equipment or other foundations.

6. Fencing and retaining walls.

7. Paved parking areas.

8. Abandoned railroad tracks, ties, and scrap iron.

9. Ancillary structures such as shacks and outhouses.

10. Trees, stumps, bushes, shrubs, roots, limbs and logs.

11. All rubbish and debris whether above or below ground.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials required to perform work as specified.

PART 3 - EXECUTION

3.01 GENERAL

A. Clear entire project right-of-way and such other areas, including public or corporate lands, specified in the plans of all structures and obstructions.

B. Trim carefully all trees and shrubs designated for preservation and protect from scarring or other injuries during construction operation.

C. Removal of all foundations and underground obstructions, unless otherwise specified, shall be removed to the following depths:

   1. In embankment areas, two (2) feet below natural grounds.

   2. In excavation areas, two (2) feet below the lower elevation of excavation.

   3. In all other areas, one (1) foot below natural grade.

D. Backfill all holes, as directed by the ENGINEER, resulting from all removals.

E. Complete the preparation of right-of-way such that prepared right-of-way is free of holes, ditches and other abrupt changes in elevations and irregularities to contours.

F. Plug the remaining ends of all abandoned storm sewers, culverts, sanitary sewers, conduits and utility pipes with concrete, as specified by the ENGINEER, to form a tight closure.

G. On existing concrete where only a portion is to be removed, care shall be exercised to avoid damage to remaining concrete. Where concrete reinforcement is encountered in removed portions, a minimum of one (1) foot of such reinforcement shall be cleaned of old concrete and left in place to tie into new construction. Concrete to be preserved, but subsequently destroyed by the CONTRACTOR'S operations, shall be replaced by the CONTRACTOR at his expense in accordance with City Specifications, or as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PREPARATION OF RIGHT-OF-WAY

A. Preparation of right-of-way shall be measured by one of the following methods: on a lump-sum basis; by the acre; or by the linear foot along the centerline of construction (regardless of the width of the right of way). The measurement for payment made only on areas indicated and classified on the plans as preparation of right-of-way.

B. When not listed as a separate contract pay item, preparation of right-of-way shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02102 CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Cleaning and grubbing shall consist of the removal of trees, stumps, brush, roots, vegetation, logs, rubbish, railroad rails, railroad ties, abandoned monitoring well and other objectionable matter within the project site limits described in the specifications or as shown on plans.

B. Cleaning and grubbing shall be done in advance of grading operation. Grubbing may be done simultaneously with excavation, if the cuts are over 3 feet in depth and objectionable matter is removed as specified.

C. Clearing and Grubbing shall consist of the disposal of all debris resulting from the work specified herein.

1.02 PROTECTION OF ADJACENT WORK:

A. Provide protection necessary to prevent injury or damage to existing improvements, adjacent property, utilities and other facilities, and trees and plants, indicated to remain in place.

B. Protect improvements on adjoining properties and all areas outside indicated construction areas from injury or damage.

B. Restore damaged improvements to their original condition, as acceptable to the Engineer and property owners.

D. Conduct site clearing and grubbing operations to ensure minimum interference with road, streets, alleys, walks, and other adjacent, occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide all required personnel, equipment, and materials required to perform the work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

A. Clear all areas proposed to be covered by dikes, roads, drainage facilities, curbing, sidewalks, landscaping, structures and embankments within project limits unless otherwise shown in plans.

B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.

C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not to be removed.

3.02 GRUBBING:

A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:

1. Footings	18-inches below bottom of footing.
2. Sidewalks (or other types of walks)	12-inches below bottom of walk.
3. Roadways or Streets	24-inches below bottom of base material.
4. Parking Areas	24-inches below bottom of base material.
5. Grassed Areas	18-inches below top soil.
6. Fills	24-inches below bottom of fill.
7. Abandoned Utilities	72-inches below natural ground

B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

A. Burn as permitted by regulating agencies and the Engineer as work progresses.

B. Unguarded fires will not be permitted.

C. Permits will be obtained, where required, for necessary burning or disposal sites.

D. Dispose of all waste materials not burned by removal from site.

E. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING:

A. Clearing and Grubbing shall be measured for payment either in acres or by lump sum only for areas indicated on the plans, or as provided in the proposal and contract.

B. When not listed as separate contract pay item, Clearing and Grubbing shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor equipment, tools and in incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02103 CONCRETE REMOVAL

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of breaking up, removing and satisfactorily disposing of existing concrete, as classified, at locations indicated or as directed by the Engineer.

B. Existing concrete, when under this section, will be classified as follows:

1. Concrete Curb will include curb, curb-and-gutter and valley gutters.

2. Concrete Slabs will include, but not be limited to, patio slabs, porch slabs, foundation systems, riprap and concrete pavement.

3. Sidewalks and Driveways will include concrete sidewalks and driveways.

4. Concrete Walls will include all walls, regardless of height and wall footings.

5. Concrete Steps will include all steps and combinations of walls and steps.

6. Abandoned Foundations will include abandoned utilities foundations.

7. Miscellaneous Concrete shall include, but not be limited to, manholes, inlets, junction boxes and headwalls, as indicated by the plans or the Engineer.

PART 2 PRODUCTS

2.01 MORTAR:

A. Mortar, for repair of existing concrete structures, shall conform to the requirements thereof in Section 3300 - Cast-In-Place Concrete.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

A. Prior to commencing this work, all erosion control and tree protection measures required shall be in place and all utilities located and protected. The existing concrete shall be broken up, removed in accordance with

Section 2101 - "Preparation of Right-of-Way", and disposed of at a permitted disposal site by the Contractor.

B. Where only a portion of the existing concrete is to be removed and the remaining portion is to continue to serve its purpose, care shall be exercised to avoid damage to the portion that will remain in place.

C. The existing concrete shall be cut along neat lines when indicated, or as established by the Engineer, by sawing with an appropriate type circular concrete saw to a minimum depth of 1/2 inch.

D. Any reinforcing steel encountered shall be cut off 1 inch inside of the concrete sawed line. Any existing concrete which is damaged or destroyed beyond the neat lines so established, shall be replaced at the Contractor's expense.

E. The remaining concrete shall be grouted and / or sealed to protect the reinforcing steel while providing a neat, clean appearance.

F. When applicable, a minimum of 1 foot of steel length shall be cleaned of all old concrete and left in place to tie into the new construction when reinforcement is encountered in the removed portions of structures to be modified.

G. All unsuitable material shall be removed and replaced with approved material.

H. All foundation, walls or other objectionable material shall be removed to a minimum depth of 18 inches below all structures and 12 inches below areas to be vegetated.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Concrete curb when removed as prescribed above, will be measured by the linear foot, in its original position, regardless of the dimensions or size.

B. Concrete slabs and concrete sidewalks and driveways removed as prescribed above will be measured by the square foot or square yard in original position, regardless of the thickness and reinforcing.

C. Concrete steps removed will be measured per linear foot or square foot of each individual step tread including the bottom step.

D. Concrete foundation removed will be measured per square yard.

E. Miscellaneous concrete removed will be measured per square yard each.

4.02 PAYMENT:

A. This item will be paid for at the contract unit price bid for "Removed Concrete Curb", "Removed Concrete Slab", "Remove Concrete Sidewalks and Driveways", "Removed Concrete Foundations" and "Remove Miscellaneous Concrete", which price shall be full compensation for all work herein specified, including the disposal of all material not required in the work, the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

B. When not listed as a separate contract pay item, removal of concrete shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work, will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02210 GRADING AND EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Grading and earthwork which occurs in areas other than under structures, under paving, or trenching for utilities.

B. Earthwork consists of operations required for the excavation of materials on site; excavation of borrow material from designated areas; compaction of natural or improved sub-grades: finish grading; disposal of excess or unsuitable materials; and other required operations. Earthwork shall conform with dimensions and typical sections shown, and within lines and grades established on Drawings.

1.2 RELATED SECTIONS:

A. Trenching, structure excavation, backfilling and grading - Section 02221.

B. Excavating, backfilling and compacting for utilities - Section 02225.

1.3 REFERENCES:

A. ASTM D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 lbf/ft^3).

B. ASTM D4972 - pH of Soil.

C. ASTM G57 - Field Measurement of Soil Resistivity Using the Wenner Four Electrode Method.

D. ASTM D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.4 EXISTING UTILITIES:

A. Where pipes, ducts and structures are encountered in the excavation but are not shown on the Drawings, immediately notify the ENGINEER.

1.5 DEFINITIONS:

A. Classification: Earthwork materials are classified in accordance with definitions in this Article.

B. Topsoil: Top 6 inches of natural surface soil possessing the characteristics of representative soils on the site that produce growths of grass or other vegetation. Topsoil includes roots and other vegetation.

C. General Site Fill: Suitable, clean material excavated on-site or off-site may be used as fill material. Suitable material shall consist of clay soils classified as CH according to the unified soil classification system. Clay soil used as fill shall have a liquid limit of less than 55 and a Plasticity Index comparable with on-site soils.

D. Select Fill: Select fill material, as required for construction, defined in the plans and/or Sections 02221 and 02225, shall consist of inorganic silty or sandy clay.

E. Subgrade: Consists of that portion of the surface on which a compacted fill, backfill or topsoil is placed.

F. Borrow: Material taken from on-site designated areas or approved off-site sources to make up any deficit of excavated material. Obtain from area that is normally dry and well drained. Borrow does not include top soil.

G. Finish Grading: Operations required for smoothing disturbed areas that are not overlaid with pavement.

H. Excavation: Excavation of every description and of whatever substances encountered within the limits of the project to the lines and grades indicated on the Drawings.

I. Compaction: Compaction of soil materials shall be measured as a percent of Standard Proctor density as determined by the ASTM D698.

PART 2 - PRODUCTS

2.1 SELECT FILL:

A. Source: Obtain select fill material from required excavation, or if excavated material is not adequate, from borrow areas approved by the ENGINEER. Material from source shall be tested for compliance with project requirements and approved by the Owner and Testing Laboratory.

B. Suitability: Use the best material available from excavation or borrow, suitability of select fill is subject to the ENGINEER'S approval.

C. Quality: Select fill material must be free of rock and clay lumps or excessive silts. Do not use soil containing brush, roots, sod or similar organic materials.

D. Characteristics: Select fill material shall consist of inorganic silty or sandy clay. Additional select fill requirements are described in Sections 02225.

2.2 FILL AND BACKFILL UNDER TOPSOIL:

A. Source: Obtain site fill from required excavation or, if excavated material is not sufficient, from borrow areas approved by the ENGINEER.

B. Suitability: Use the best material available from excavation or borrow. Suitability of fill material is subject to the Testing Laboratory\Engineer's approval.

C. Quality: Fill material shall be free of excessive silts. Do not use soil containing brush, roots, sod or similar organic materials.

D. Characteristics: Fill material shall have a plasticity index between 6 and 25, inclusive, and shall generally be of similar character to that of existing soil at the site.

PART 3 – EXECUTION

3.1 STRIP AND STOCKPILE:

A. Remove topsoil at all non-paved areas where excavation of topsoil is required or where fill material will be added for site grading. Remove top 6 inches of topsoil where necessary and stockpile on the property as directed by the Owner. Protect stockpiled topsoil from other excavated materials, dumping of unwanted material, dumping by the public, and erosion. Upon completion of rough grading, replace topsoil in 4-inch minimum layer to finish grade elevations as shown on the grading plan.

B. Removal of topsoil in building areas and paving areas is further described under provisions of Section 02225.

3.2 EXCAVATION:

A. Objective: As shown on the Drawings, excavate to lines, grades and elevations required for subsequent construction. All excavation shall be made in such manner as to permit all surfaces to be brought to final line and grade within plus or minus 0.1 foot. Over excavation shall be restored by the Contractor at his own expense. Finished grades consistently high or low will not be acceptable and shall be corrected by the Contractor at his expense and no additional cost to the Owner.

B. Drainage: During excavation, maintain grades as required to provide positive drainage away from structures; or, as directed by the Engineer, install

temporary drains or drainage ditches to intercept or divert surface water and prevent interference or delay of the work.

C. Stockpiling: If, at time of excavation, it is not possible to place material in the proper section of permanent construction, CONSTRACTOR shall stockpile the material in Owner or Architect approved areas for later use.

D. Stone or Rock: Stone or rock fragments greater than 6" will not be allowed in fills or embankments. Stones or rock fragments larger than 2 inches in their greatest dimension will not be permitted in top 6 inches of subgrade.

E. Dressing: Uniformly dress, cut and fill slopes to slope, cross section and alignment, as shown.

3.3 TREATMENT OF SUBGRADES:

A. All topsoil and vegetation shall be stripped from the ground surface and stockpiled, exposing sound undisturbed subgrade soils.

B. After stripping the topsoil in areas to receive fill or cut areas, the exposed ground surface shall be scarified to a depth of 6 inches, the moisture adjusted, and then recompact to a minimum density of 95 percent of the maximum density as obtained in the Standard Proctor Compaction Test (ASTM D698), at a moisture content between minus 1 to plus 3 percent of optimum. Any soft or compressible areas detected during the recompaction process shall be undercut such that sound subgrade soils are exposed and recompacted. Site excavated or select fill shall then be used to bring all areas to grade. Allow for placement of minimum 4-inch layer of top soil in areas not covered by building or pavement.

C. Finished subgrade shall be inspected by Testing Laboratory for determination that subgrade meets requirements of Contract Documents.

3.4 PLACING FILL AND BACKFILL:

A. Examination of Subgrade: Do not place fill on any part of the subgrade until the subgrade preparation has been accepted by the Engineer.

B. Removing Debris: During the dumping and spreading process, remove all roots, stones and debris that are uncovered in the fill material.

C. Spreading Fill and Backfill: After dumping, spread the material in horizontal layers over the entire fill area. The thickness of each layer before compaction shall not exceed 8 inches unless otherwise directed by the Engineer. Maintain positive drainage throughout construction. The combined excavation and fill placing operation shall be such that the material when compacted in

the fill will be blended sufficiently to secure the best practicable degree of compaction. The suitability of the materials shall be subject to testing by the Testing Laboratory and approval of the Engineer. After each layer of fill has been spread to the proper depth, it shall be thoroughly manipulated with a disc plow or other suitable and approved equipment until the material is uniformly mixed, pulverized and brought to uniform approved moisture content.

D. Attaining Proper Bond: If, in the opinion of the Testing Laboratory, the compacted surface of a layer is too smooth to bond with succeeding layers, loosen the surface by harrowing or other approved method before continuing the work.

E. Place materials to proper elevation allowing for depth of topsoil furnished under this Contract.

3.5 MOISTURE CONTROL:

A. Intent: Developing the maximum density obtainable with the natural moisture of the material is preferred. However, the moisture content shall not vary from the optimum, as determined by ASTM D698, by more than minus 1 to plus 3 percent of optimum.

B. Adjustment: If the moisture content is too high, adjust to within the specified limits by spreading the material and permitting it to dry. Assist the drying process by discing or harrowing if necessary. When the material is too dry, sprinkle each layer with water. Work the moisture into the soil by harrowing or other Engineer approved method.

3.6 COMPACTION:

A. Rough Grade: Compact each layer of fill material with suitable equipment as necessary to secure 95% to 98% Standard Proctor Density (ASTM D698) within the specified range of the moisture content.

B. Finish Grade: Place and lightly compact topsoil to achieve finish grades.

3.7 DISTRIBUTION OF TOPSOIL:

A. Perform rough grading and topsoil/finish grading work.

B. Preparation:

1. Prior to placing topsoil, scarify the subgrade to a depth of 2 inches to provide effective bonding of the topsoil with the subgrade.

2. Shape all areas designated for grading, including cut and fill areas, to receive a minimum of 4 inches of topsoil

C. Placement:

1. Do not haul or place wet topsoil. Also prohibited is placement of topsoil on a subgrade that is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or proposed planting.

2. Distribute topsoil uniformly and spread evenly. Correct irregularities in the surface to prevent formation of depressions where water could stand.

3. Perform the spreading operation so that planting can proceed with little additional tillage or soil preparation. Leave the area smooth and suitable for lawn planting.

4. Lightly compact topsoil to obtain proper bond with previously placed or prepared material.

D. Maintenance: Where any portion of the surface becomes eroded or otherwise damaged, repair the affected area to establish the condition and grade prior to topsoil placement; then replace topsoil.

3.8 MATERIAL DISPOSAL:

A. Excess Excavation Material (soil material free of trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has been accepted by the Geotechnical Engineer): Remove excess excavated material from the construction site or place on the property as directed by the ENGINEER.

B. Waste Material (soil material including trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has not been accepted by the Geotechnical Engineer): Remove waste material from the project site before Final Inspection. Legally dispose of material at a licensed site or with written and notarized permission from the property owner for a private disposal site. All costs associated with waste material removal and disposal shall be paid for by the Contractor.

PART 4 - TESTING

A. The testing laboratory will make tests of in-place density in accordance with ASTM Standards. Backfill operations will be monitored continuously by the testing laboratory at structures. It will be the responsibility of the CONTRACTOR to notify the testing laboratory before backfill operations begin.

PART 5 - MEASUREMENT AND PAYMENT

A. No separate payment shall be made to the CONTRACTOR for the work described in this Section. Such work shall be considered incidental to the project and the payments made under specific Pay Items shall be considered as full compensation for these requirements.

END OF SECTION

SECTION 02220 SUBGRADE PREPARATION

PART 1 – GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of scarifying, blading and rolling the sub-grade to obtain a uniform texture and provide as nearly as practical a uniform density for the 6 inches of the sub-grade.

PART 2 - EXECUTION

3.01 CONSTRUCTION METHODS:

A. All preparing of the right-of-way and/or clearing and grubbing shall be completed before starting the sub-grade preparation.

B. The sub-grade shall be scarified and shaped in conformity with the typical sections and the lines and grades indicated or as established by the ENGINEER by the removal of existing material or addition of approved material.

C. All unsuitable material shall be removed and replaced with approved material.

D. All foundations, walls or other objectionable material shall be removed to a minimum depth of 18-inches under all structures and 12-inches under areas to be vegetated. All holes, ruts and depressions shall be filled with approved material.

E. The surface of the sub-grade shall be finished to the lines and grades as established and be in conformity with the typical sections indicated.

F. Any deviation in excess of ½ inch cross section and in a length of 10 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and compacting by sprinkling and rolling.

G. Sufficient sub-grade shall be prepared in advance to insure satisfactory prosecution of the work.

H. The CONTRACTOR will be required to set blue tops for the sub-grade on centerline, at quarter points and curb lines or edge of pavement at intervals not exceeding 50 feet.

I. All suitable material removed may be utilized in the sub-grade with the approval of the ENGINEER. All other material required for completion of the sub-grade shall also be subject to approval by the ENGINEER.

J. Sub-grade materials on which structures shall be placed shall be compacted by approved mechanical tamping equipment to a dry density of the total material of not less than 95 percent nor more than 100 percent of the maximum dry density as determined in accordance with SDHPT Test Method Tex-114-E.

K. Sub-grade materials on which planting or turf will be established shall be compacted to a minimum of 90 percent of the maximum dry density as determined in accordance with SDHPT Test Method Tex-114-E.

L. Tests for density will be made as soon as possible after compacting operations are completed. If the material fails to meet the density specified, it shall be reworked as necessary to obtain the density required.

M. Just prior to placing any base materials, density and moisture content of the top 6 inches of compacted sub-grade shall be checked and if tests show the density to be more than 2 percent below the specified minimum or the moisture content to be more than 3 percent above or below the optimum, the sub-grade shall be reworked as necessary to obtain the specified compaction and moisture content.

N. Proof Rolling is require before placing base material in conformity with Item 02686 “Proof Rolling”

N. When lime stabilization of the sub-grade is specified, the lime is to be added in accordance with Section 02240, Lime Stabilization.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. All acceptable sub-grade preparation will be measured by the square yard.

B. The measured area includes the entire width of the roadway for the entire length as indicated.

4.02 PAYMENT:

A. The accepted quantities of sub-grade preparation will be paid for at contract unit bid price per square yard.

B. When not listed as a separate contract pay item, sub-grade preparation shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

02221 TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading and cleanup of all pipeline trenching.

B. All work must be performed in accordance with these specifications and the safety requirements of the State and OSHA standards.

1.02 JOB CONDITIONS

A. Site Acceptance

1. Contractor shall accept the site conditions existing during the Contract Time.

2. Ground water and surface water are conditions of the contract and the responsibility of Contractor.

B. Adverse Weather

1. Place no backfill that is wet or frozen.

2. Place no backfill in wet or frozen trenches.

PART 2 - PRODUCTS

2.01 PIPE BEDDING AND BACKFILL

The types of material to be used for bedding and backfill are identified on the Drawings or in the Special Provisions of the contract documents. Material types are defined either by class in accordance with ASTM D2321, or by product description. Contractor is responsible for determination of source of materials and shall submit characterization analysis and physical sample of proposed bedding material for approval prior to construction.

A. Class Designations Based on Laboratory Testing (ASTM D2321 and by reference ASTM D2487 and D653).

1. Class IA: Manufactured aggregates (angular crushed rock/gravel), open-graded, clean.

a. Plasticity Index: Non-plastic.

b. Gradation: 100% passing 1½" sieve, ≤ 10% passing No. 4 sieve, and < 5% passing No. 200 sieve.

2. Class IB: Mixture of manufactured aggregates (Class 1A) and sand, dense-graded, clean.

   a. Plasticity Index: Non-plastic.

   b. Gradation: 100% passing 1½" sieve, ≤ 50% passing No. 4 sieve, and < 5% passing No. 200 sieve.

3. Class II: Well and poorly graded gravels and sands, clean or with little to moderate fines (silt and clay).

   a. Plasticity Index: Non-plastic.

   b. Gravel: 100% passing 1½" sieve, < 5% passing No. 200 sieve (i.e. <5% fines), and < 50% of the non-fines passing a No. 4 sieve.

   c. Sand: 100% passing 1½" sieve, < 5% passing No. 200 sieve (i.e. <5% fines), and > 50% of the non-fines passing a No. 4 sieve.

   d. Gravel, Sand with Fines: 100% passing 1½" sieve, and 5% to 12% passing No. 200 sieve (i.e. 5% to 12% fines).

4. Class III: Silty/clayey gravels and sands, gravel-sand-silt/clay mixtures.

   a. Plasticity Index: (Refer to ASTM D2321)

   b. Gradation: 100% passing 1½" sieve, 12% to 50% passing No. 200 sieve.

* Note: Dense-graded (i.e. well graded) and open-graded (i.e. poorly graded) materials are defined on the basis of the coefficient of uniformity, $Cu = D_{60}/D_{10}$, and the coefficient of curvature, $Cc = (D_{30})^2/(D_{10} \times D_{60})$, where D_{60}, D_{30}, and D_{10} represent the sieve opening dimensions through which 60%, 30%, and 10% of the material would pass, respectively:

Dense-graded: $1 \leq Cc \leq 3$ for both gravel and sand, plus $Cu \geq 4$ for gravel; $Cu \geq 6$ for sand.
Open-graded: Either Cc or Cu criteria for dense gradation are not met.

B. Designations Based on Product Descriptions:

1. Excavated Material Backfill: Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6" and frozen earth, debris and roots larger than 2" are removed for the initial backfill. Plasticity Index shall be less than 30. Excavated backfill material must be approved by Engineer.

2. Select Backfill: Select Backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay. Rock cuttings shall have no dimensions greater than 2 inches. Plasticity Index shall be between 7 and 22. Select backfill must be approved by Engineer.

3. Sand Backfill: Sand backfill shall be clean, hard, durable, uncoated grains, free from lumps and organic material. All materials must pass a No. 8 sieve with less than 5% passing a No. 200 sieve (equivalent to ASTM 2321 Class II Sand Gradation excluding material captured on No. 8 sieve).

4. Granular Backfill: Granular backfill shall be free flowing, such as sand or hydraulically graded stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.

5. Controlled Density Fill: Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture having 28-day compressive strength of 70 psi minimum and 150 psi maximum with no measurable shrinkage or surface settlement.

2.02 CRADLING ROCK

A. Use crushed rock or stone with 70-100% passing 1½ inch sieve and no more than 50% passing 1 inch sieve.

2.03 GEOTEXTILE MATERIAL FOR UNSTABLE TRENCHES

A. Where unstable wall or trench bottom conditions are present as determined by the Engineer, a geotextile material shall be installed.

B. The geotextile shall be designed to prevent loss of trench support caused by migration of sand and fines into the embedment matrix and secure the embedment around the pipe.

C. The geotextile shall be a nonwoven, needle point construction and shall consist of long-chain polyethylene or polyamide. The fibers shall be oriented into a stable network whereby they retain their positions with each other. The textile shall be free of any chemical treatment commonly found in soil. The geotextile

shall conform to the following properties:

Tensile Strength: ASTM D 4632	130 LBS.
Elongation: ASTM D 4632	50%
Mullen Burst Strength: ASTM D 3786	250 psi
Coefficient of Permeability: K-cm/sec. (20 CFMC-GET-2, Constant Head) ASTM D 4491	0.10cm/sec.
Puncture Strength:	80 LBS.

D. The geotextile shall be furnished in protective wrapping to protect the material from ultraviolet radiation, contamination from other substances, and abrasion or shipping damage. Any material received damaged, shall be rejected.

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering

1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on wet soil.

2. Prevent surface water from flowing into excavation.

3. Provide equipment for handling water encountered as required. Obtain Engineer's prior approval of proposed method of dewatering.

4. No sanitary sewer shall be used for disposal of trench water.

B. Protection of Existing Utilities

1. Notify all utility companies of location and schedule of work.

2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility companies and Engineer of conflicts between existing and proposed facilities.

3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the Contractor's expense.

C. Sheeting, Shoring and Bracing

1. All sheeting, shoring, and bracing shall be in accordance with the Contractor's Excavation Safety System Plan and the safety requirements of the State and OSHA Standards.

2. Provide as necessary to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.

3. Leave Sheeting and shoring in place where removal might cause personal injury or damage to the work.

4. When movable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade

1. Grades may be adjusted by written field order from the Engineer to suit unforeseen construction conflicts or conditions. Where the bid includes a single bid price for all depths, no additional compensation will be made for adjustments within 1.5 feet of the plan grades.

3.02 EXCAVATION AND TRENCHING

A. General

1. Method of excavation is Contractor's option.

2. Allow no more than 300 feet of trench to be open at one time.

3. Excavate by hand under and around structures, utilities, and roots of trees required to be left in place.

4. Stockpile and replace topsoil to a minimum of 8 inches for surface restoration in grassed or agricultural areas.

B. Trench Characteristics

1. Depth: As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified.

2. Width: Trench width shall be no less than pipe O.D. plus 16 inches or pipe

O.D. × 1.25 + 12 inches, whichever is greater.

3. Trench walls must be vertical below top of pipe and may be vertical or sloped above pipe to conform to excavation codes.

4. Trench boxes and shoring shall not be set below the top of the embedment zone.

5. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.

6. Trench bottom shall be free of large stones and other foreign material.

3.03 SOFT, SPONGY OR UNSTABLE MATERIALS (e.g. peat, muck, and highly expansive soils)

A. Stop work and notify Engineer.

B. Perform remedial work as directed.

C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

3.04 ROCK EXCAVATION

A. Excavate any rock to maintain minimum 6-inch clearance around pipe.

B. Dispose of rock material not suitable for backfill as directed by Engineer.

C. Use of explosives not permitted without prior written authorization from Owner and Engineer.

D. Provide Special Hazard Insurance covering liability for blasting operations.

3.05 PIPE EMBEDMENT

Pipe embedment includes materials placed in the zone surrounding the pipe including bedding, haunching, and initial backfill over the top of pipe. Refer to the pipe bedding details on the Drawings for material types to be used in the pipe embedment zone.

A. Bedding

1. Place after bottom of trench has been excavated to proper depth and grade.

2. Place, compact and shape bedding material to conform to barrel of pipe and bell to insure continuous firm bedding for full length of pipe.

B. Haunching (bottom of pipe to springline)

1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.

2. Do not backfill until any required concrete or mortar has sufficiently cured.

3. Work bedding material under pipe haunches and compact by hand to springline of pipe in 6-inch lifts.

C. Initial Backfill

1. From springline to not less than 12 inches above top of pipe, place backfill and compact in 6-inch layers using vibratory compactors.

2. Backfill simultaneously on both sides of pipe to prevent displacement.

3. Record location of connections and appurtenances before backfilling.

D. Embedment in Unstable Soils

1. Where the Engineer determines that the trench bottom or wall is unstable at the bedding zone, special pipe embedment material stabilization shall be required.

2. Unstable bedding zone conditions shall be determined immediately after trench excavation by checking soil bearing strength capacities at the bedding zone using a Standard Pocket Penetrometer or other appropriate means. A minimum of three readings shall be obtained and averaged. The soil to be tested in the bedding zone shall not be allowed to dry, and shall be tested under “in-situ” conditions. If, in the Engineer’s opinion, the soil has dried, the Penetrometer Test shall be taken after removing a sufficient amount of soil from the wall or bottom surface in order to obtain a representative sample.

3. If the average reading is less than 8 blows per foot, then the pipe bed shall be prepared as follows:

   a. The trench shall be dewatered to the greatest extent possible and rock shall be placed and compacted to form a firm trench bottom. No pipe shall be laid until stabilization is to the satisfaction of the Engineer.

   b. A geotextile material shall be placed in the trench and the embedment material and pipe installed as indicated on the Drawings. Overlap geotextile around the top of the pipe envelope a minimum of 12 inches.

c. The geotextile shall be installed in accordance with the manufacturer's recommendations. Prior to installation, the geotextile shall be stretched, aligned, and placed without any wrinkles. If the material is damaged or punctured, the damaged area shall be patched by overlapping and stitching.

4. Where the trench wall is unable to support trench boxes at a level above the top of the embedment zone, sheeting shall be used for trench wall stabilization to enable such use of trench boxes or as stand-alone trench protection in lieu of trench boxes. Sheeting installed below the top of the embedment zone shall be extracted vertically in incremental steps of one (1) foot or less. Embedment material shall be placed in loose lifts before each extraction step and thoroughly compacted immediately after each step to ensure that no compacted lift is disturbed by subsequent extraction. Contractor shall ensure the soils of the trench walls on both sides of the embedment zone remain as dense as the original unexcavated condition so that the pipe embedment remains firmly supported. In no case shall a trench box be permitted to rest below the top of the embedment zone.

E. Embedment of Flexible Pipe in Saturated Soils (Sewer Pipe Only)

1. Consolidated Soils: Pipe embedment may be installed using least restrictive, open-graded material.

2. Unconsolidated, Stable Soils: Dense-graded material shall be used to prevent loss of trench support caused by migration of soil into the embedment matrix. Alternately, open-graded embedment may be used in combination with geotextile fabric as specified for unstable soil.

3.06 TRENCH BACKFILL

A. Final Backfill

1. Place backfill into trench at an angle so that impact on installed pipe is minimized.

2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, or cause the installed pipe to be moved from the established grade and alignment.

3. Place minimum cushion of 3 feet of compacted backfill above pipe envelope before using heavy compacting equipment.

4. Use excavated material for final backfill subject to the requirements for Excavated Backfill unless otherwise specified.

5. Areas under or within 5 feet of pavement, and under or within 2 feet of utilities, buildings, or walks shall be backfilled with sand and mechanically compacted to the top of the subgrade in 8-inch lifts to a minimum of 95% Standard Proctor Density.

6. Areas not subject to vehicular traffic shall be backfilled in layers not more than 12 inches.

7. Structural and non-structural backfill shall be mechanically compacted. Compaction method is at discretion of Contractor with following exceptions:

    a. If in Owner's opinion compaction method presents potential damage to pipe, it will not be allowed.

    b. Flooding or water jetting may be permitted only if a geotechnical report justifying the use of water jetting is submitted to the City Engineer and approval is granted.

8. Mound excavated materials no greater than 6 inches in open areas only.

9. Fill upper portion of trench with topsoil as specified hereinbefore.

B. Controlled Density Fill

1. Use where shown on plans.

2. Provide suitable forms to limit volume of control density fill material.

3. Prevent flow of material into existing drain lines.

4. Protect exposed utility lines during placement.

5. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer.

3.07 EXCESS MATERIAL

A. Disposal of excess excavated material shall be the responsibility of the Contractor.

3.08 TESTING

A. Unless specified elsewhere, testing will be responsibility of Owner.

B. Standard Proctor Density

1. ASTM D698.

2. One (1) required for each type of material encountered.

C. In Place Density

1. ASTM D1556 (Sand Cone)

2. ASTM D2167 (Balloon)

3. ASTM D3017 (Nuclear)

D. One (1) test per 250 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for non-structural areas. One (1) test per 100 linear feet of trench on alternating lifts, with a minimum of three tests per visit, for structural areas.

E. Contractor will be responsible for any costs associated with testing performed as a result of failed tests

PART 4 - MEASUREMENT AND PAYMENT

4.01 TRENCH EXCAVATION

A. Trench excavation shall be considered incidental to pipeline installation.

B. Payment shall be made at the contract unit price per cubic yard only if a bid item is established in the contract.

4.02 BACKFILL

A. Backfill shall be considered incidental to pipeline installation.

B. Payment for backfill shall be made at the contract unit price per cubic yard only if a separate bid item is established in the contract.

C. No allowance for waste shall be made.

D. If Engineer orders a bedding backfill material other than that specified in contract, it shall be paid for as an extra in price per cubic yard as compacted in place, EXCEPT if a higher class embedment is ordered by Engineer because the Contractor has over-excavated the trench.

E. If the Engineer orders the excavated material to be removed and disposed of

and replaced with another material and a separate bid item for that material has not been established, the material shall be paid as an extra.

F. If the Contractor fails to compact the backfill to the density requirements, the Engineer may order the material removed and replaced at no cost to the Owner.

G. The disposal of rejected material shall be at no cost to the Owner.

H. Payment for geotextile envelopment in unstable trench soils shall be made at the bid price for “Trench Stabilization in Unstable Soils” in the bid form.

END OF SECTION

SECTION 02223 TRENCH EXCAVATION PROTECTION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of shoring, bracing, bank stabilization, bank sloping, providing trench boxes or trench shields or other equivalent means to protect employees from the effects of moving ground or cave-ins.

B. These specifications apply to any trench excavation which is over five (5) feet in depth from the ground surface, or trench excavations that are less than five (5) feet in depth located in areas where unstable soil conditions are present (Ref. OSHA Safety and Health Regulations, Part 1926, Subpart P, Paragraph 29 CFR 1926.652, Subparagraph (a).

C. All work shall be done in conformance with OSHA Safety and Health Standards (29 CFR 1926/1010 Chapter XVII Subpart P-Excavations, Trenching and Shoring.). It is the Contractor's responsibility that all excavation work and site conditions are within the regulations as established by OSHA. Any property damage or bodily injury (including death) that arises from use of the trench safety systems, from the Contractor's negligence in performance of the contract work, shall remain the sole responsibility and liability of the Contractor.

1.02 DEFINITIONS APPLICABLE TO THIS SPECIFICATION

A. "Accepted engineering requirements (or practices)" - Those requirements or practices which are compatible with standards required a Registered Professional Engineer, or other duly licensed or recognized authority.

B. "Angle of repose" - The greatest angle above the horizontal plane at which a material will lie without sliding.

C. "Bank" - A mass of soil rising above a digging level.

D. "Belled excavation" - A part of shaft or footing excavation, usually near the bottom and bell-shaped; i.e., an enlargement of the cross section above.

E. "Braces (trench)" - The horizontal members of the shoring system whose ends bear against the uprights or stringers.

F. "Excavation" - Any manmade cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms

or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

G. "Faces" - See paragraph (K) of this section.

H. "Hard compact soil" - All earth materials not classified as running or unstable.

I. "Kickouts" - Accidental release or failure of a shore or brace.

J. "Sheet pile" - A pile, or sheeting, that may form one of the continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.

K. "Sides", "Walls", or "Faces" - The vertical or inclined earth surfaces formed as a result of excavation work.

L. "Slope" - The angle with the horizontal at which a particular earth material will stand indefinitely without movement.

M. "Stringers" (wales) - The horizontal members of a shoring system whose sides bear against the uprights or earth.

N. "Trench" - A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15-feet.

O. "Trench shield" - A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

P. "Unstable soil" - Earth material, other than running, that because of its nature of the influence of related conditions cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

Q. "Uprights" - the vertical members of a shoring system.

R. "Wales" - See paragraph M of this section.

S. "Walls" - See paragraph K of this section.

PART 2 - PRODUCTS

No information for this section

PART 3 - EXECUTION

3.01 GENERAL PROTECTION REQUIREMENTS

A. Walkways, runways, and sidewalks shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of one hundred and twenty-five (125) pounds per square foot.

B. If planks are used for raised walkways, runways, or sidewalks they shall be laid parallel to the length of the walk and fastened together against displacement.

C. Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.

D. Raised walkways, runways, and sidewalks shall be provided with plank steps on string stringers. Ramps, used in lieu of steps, shall be provided with cleats to insure a safe walking surface.

E. All employees shall be protected with personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet and other parts of the body as set forth in OSHA Standards.

F. Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with or made or reflectorized with high visibility material.

G. Employees subjected to hazardous dusts, gases, fumes, mists, or atmospheres deficient in oxygen, shall be protected with approved respiratory protection as set forth in OSHA Standards.

H. No person shall be permitted under loads handled by power shovels, derricks, or hoists. To avoid any spillage, employees shall be required to stand away from any vehicle being loaded.

I. Daily inspections of excavations shall be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard employees.

3.02 SPECIFIC EXCAVATION REQUIREMENTS

A. Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., sewer, telephone, water, fuel, electric lines,

etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

B. Trees, boulders, and other surface encumbrances, located so as to create a hazard employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed o made safe before excavating is begun.

C. The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground or some other equivalent means.

D. Excavations shall be inspected by a competent person after ever rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

E. The determination of the angle of repose and design of the supporting system shall be based on careful evaluation of pertinent factors such as: Depth of cut; possible variation in water content of the material while the excavation is open; anticipated changes in materials from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, overlying materials, or stored material; and vibration from equipment, blasting, traffic, or other sources.

F. Supporting systems, i.e., piling, cribbing, shoring, etc., shall be designed by a qualified person and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose. When tight sheeting or sheet piling is used, full loading due to ground water table shall be assumed, unless prevented by weep holes or drains or other means. Additional stringers, ties, and bracing shall be provided to allow for any necessary temporary removal of individual supports.

G. All slops shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.

H. The angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas were erosion deep frost action and slide planes appear.

I. Clearances:

1. In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2-feet or more from the edge of the excavation.

2. As an alternative to the clearance prescribed in subparagraph 1, the Contractor may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the excavation.

J. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing or other equally effective means. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.

K. Support systems shall be planned and designed by a qualified person when excavation is in excess of 20-feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.

L. Materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots, and of proper dimensions.

M. Special precautions shall be taken in sloping or shoring the sides of excavations adjacent to previously backfilled excavation for a fill, particularly when the separation is less than the depth of the excavation. Particular attention also shall be paid to joints and seams of material comprising a face and the slope of such seams and joints.

N. Except in hard rock, excavations below the level of the base of footing of any foundation or retaining wall shall not be permitted, unless the wall in underpinned and all other precautions taken to insure the stability of the adjacent walls for the protection of employees involved in excavation work or in the vicinity thereof.

O. If the stability of adjoining building or walls is endangered by excavations, shoring, bracing or underpinning shall be provided as necessary to insure their safety. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent person the protection effectively maintained.

P. Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.

Q. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.

R. Blasting and the use of explosives are not allowed unless authorized in other portions of the specifications.

S. When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.

T. Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc. shall be backfilled.

U. If possible, dust conditions shall be kept to a minimum by the use of water, salt, calcium chloride, oil, or other means.

V. In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls, as set forth in OSHA Standards shall be established to assure acceptable atmospheric conditions. When flammable gases are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, basket stretcher, etc. shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

W. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

X. Where ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.

Y. All ladders used on excavation operations shall be in accordance with requirements of OSHA Standards.

3.03 SPECIFIC TRENCHING REQUIREMENTS

A. Banks more than 5-feet shall be shored, laid back to a stable slope or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to Figure 19000-1 as a guide in sloping of banks. Trenches less than 5-feet in depth shall also be

effectively protected when examination of the ground indicates hazardous ground movement may be expected.

B. Sides of trenches in unstable or soft material, 5-feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. See Figure 19000-1 and Table 19000-1.

C. Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5-feet in depth and 8-feet or more in length. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2-foot horizontal. When the outside diameter of a pipe is greater than 6-feet, a bench of 4-foot minimum shall be provided at the toe of the sloped portion.

D. Materials used for sheeting and sheet piling, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the excavation.

E. Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.

F. Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier and securely fastened to shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.

G. Minimum requirements for trench timbering shall be in accordance with Table 19000-1. Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stresses in excess of values given by the following formula:

$$S + 1300 - \frac{20L}{D}$$

$$\text{Maximum Ratio } \frac{L}{D} = 50$$

Where:

L = Length, unsupported, inches
D = Least side of the timber in inches
S = Allowable stress in pounds per square inch of cross-section.

H. When employees are required to be in trenches 4-feet deep or more, 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.

I. Bracing or shoring of trenches shall be carried along with the excavation.

J. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically and be secured to prevent sliding, falling, or kickouts.

K. Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench. The Contractor shall provide a statement certified by a Registered Professional Engineer of the adequacy of trench boxes or shields.

L. 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.

M. The Contractor's trench safety system shall be designed to take into account all surcharge loads including, but not limited to adjacent structures, contractor's equipment and heavily loaded truck traffic which will be routed near the work site.

3.05 CONSTRUCTION REQUIREMENTS

A. The Contractor unless provided for in the plans otherwise shall provide the minimum shoring shown in Table 02223-1 for the soil class noted in the plans. If approved by the Engineer, the Contractor may slope the excavation in accordance with Table 02223-1

B. Should the soil conditions differ from those specified or should ground water be encountered in the excavation the contractor shall notify the Engineer immediately. The Contractor shall refrain from operating in that portion of the trench where changed conditions are noted until such time as an inspection of conditions takes place and the contractor is notified of measures necessary for continued operation.

C. The Contractor shall prepare and submit a plan of operation. This plan of operation shall identify material, equipment, methods and installation and shall be inspected by a Registered Professional Engineer. The Contractor's Engineer shall certify the adequacy of the trench protection system and its adherence of OSHA Standards.

PART 4- MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Providing shoring in trenches or other alternate means in accordance with this specification shall be measured by the linear foot of trench irrespective of size of pipe or depth or lump sum as shown or implied in the plans, or as provided in the proposal and contract. Additional depth for foundations, etc. shall be considered incidental to the price bid for the protection.

B. If the plans require sloping the excavation or the excavation is sloped in accordance with Figure 19000-1 after receiving permission from the Engineer, no payment will be made under this item.

C. The Contractor shall provide shoring systems for construction of structures 5-feet or greater in depth. There will be no direct payment for these systems but it shall be considered incidental to the price bid for the structure.

4.02 PAYMENT

A. Payment shall be made at the unit price bid for "Trench Excavation Protection" and include all components for design and construction of the Trench Protection System which can include, but not be limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage. Payment shall also include the additional excavation and backfill required, any jacking, jack removal, and removal of the trench supports after completion.

B. When not listed as separate contract pay item, Trench Excavation Protection shall be considered as incidental work, and the cost thereof including furnishing all materials, labor equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications, shall be incorporated in such contract pay items as are provided in the proposal contract.

END OF SECTION

TABLE 02223-1
TRENCH SHORING, MINIMUM REQUIREMENTS

		Size and Spacing of Members										
Depth Of Trench Feet	Kind or Condition of Earth	Uprights		Stringers		Cross Braces		Width of Trench		Maximum Spacing		
		Minimum Dimension Inches	Maximum Spacing Feet	Minimum Dimension Inches	Maximum Spacing Feet	Up to 3 Feet Inches	3-6 Feet Inches	6-9 Feet Inches	9-12 Feet Inches	12-15 Feet Inches	Vertical Feet	Horizontal Feet
5 to 10	Hard, Compact	3 x 4 or 2 x 6	6	---	---	2 x 6	4 x 4	4 x 6	6 x 6	6 x 8	4	6
	Likely to Crack	3 x 4 or 2 x 6	3	4 x 6	4	2 x 6	4 x 4	4 x 6	6 x 6	6 x 8	4	6
	Soft, Sandy or Filled	3 x 4 or 2 x 6	Close Sheeting	4 x 6	4	4 x 4	4 x 6	6 x 6	6 x 8	8 x 8	4	6
	Hydrostatic Pressure	3 x 4 or 2 x 6	Close Sheeting	6 x 8	4	4 x 4	4 x 6	6 x 6	6 x 8	8 x 8	4	6
10-15	Hard, Compact	3 x 4 or 2 x 6	4	4 x 6	4	4 x 4	4 x 6	6 x 6	6 x 8	8 x 8	4	6
	Likely to Crack	3 x 4 or 2 x 6	2	4 x 6	4	4 x 4	4 x 6	6 x 6	6 x 8	8 x 8	---	6
	Soft, Sandy or Filled	3 x 4 or 2 x 6	Close Sheeting	4 x 6	4	4 x 6	6 x 6	6 x 8	8 x 8	8 x 10	4	6
	Hydrostatic Pressure	3 x 6	Close Sheeting	8 x 10	4	4 x 6	6 x 6	6 x 8	8 x 8	8 x 10	4	6
15-20	All Kinds of Conditions	3 x 6	Close Sheeting	4 x 12	4	4 x 12	6 x 8	8 x 8	8 x 10	10 x 10	4	6
Over 20	All Kinds of Conditions	3 x 6	Close Sheeting	6 x 8	4	4 x 12	8 x 8	8 x 10	10 x 12	10 x 12	4	6

Trench jacks may be used in lieu of, or in combination with cross braces

Shoring is not required in solid rock, hard shale or hard slag.

Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.

SECTION 02225 UNCLASSIFIED STREET EXCAVATION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. Perform all required excavation within the limits of right of way and adjacent thereto (except excavations specifically described and provided for elsewhere in the specifications).

B. Remove, properly use, or dispose of all excavated materials.

C. Shape and finish all earth work in conformance with lines and grades as shown on the plans or as specified by the Engineer.

D. Schedule work to avoid property owner inconvenience as practical during construction.

E. Exercise care in operating applicable equipment beneath or adjacent to trees, sidewalks, poles, and other existing features to prevent damage.

F. Restore obstructions removed to accommodate construction equipment or to facilitate excavation.

1.02 CLASSIFICATION:

A. All street excavation shall be unclassified, regardless of material encountered.

B. Any reference to rock or any other material on the plans, or in these specifications, is not to be construed as classification of the excavation.

PART 2 - PRODUCTS

2.01 SUBGRADE:

A. Use on-site material moved from cut areas to fill areas as approved by Engineer.

B. Use borrow materials from areas designated as needed.

2.02 DRAINAGE PROVISIONS:

A. Interruptions of natural surface drainage or flow of artificial drains shall be mitigated by the Contractor by use of temporary drainage facilities, as approved by the Engineer, to prevent damage to public or private interest.

B. Restore original drainages as soon as the work shall permit.

C. The Contractor shall be held liable for all damages which may result from neglect to provide for either natural or artificial drainage which his work may have interrupted.

PART 3 - EXECUTION

3.01 UNCLASSIFIED STREET EXCAVATION:

A. Perform all excavation, embankment and grading required for pavement and/or curb and gutter as shown on plans.

B. Move suitable excavated material to areas requiring fill and place in accordance with these specifications. Determination of suitable material will be made by Engineer. Haul unsuitable material to waste sites.

C. Slope cut or fill sections uniformly from curb line to sidewalk or other controlling feature, as designated by Engineer. Smooth bank to provide a neat finished appearance.

D. Remove and replace unstable soils encountered during grading operations with suitable material. Notify Engineer of suspected unsuitable material before commencing removal. Authorized replacement with select material will be paid for by change order.

E. Replace gravel or rock driveway surfaces disturbed by grading with like material at no additional cost to Owner.

F. Strip, salvage and stockpile topsoil in sufficient quantity to allow a uniform 6-inch lift over all disturbed areas not otherwise surfaced. Topsoil is included in unclassified excavation.

G. Remove existing culvert pipe where shown as part of and incidental to unclassified excavation.

3.02 UNSTABLE OR UNSUITABLE SUBGRADE:

A. Excavate unstable subgrade at least 2 feet below grade where directed by Engineer.

B. Replace with suitable stable material approved by Engineer.

C. Compact to uniform density in 6-inch lifts.

D. Density of compacted subgrade to be as per plans or as directed by engineer

E. Payment will be as specified for unclassified excavation.

F. Conduct operations in such a manner such that measurements may be taken before any backfill, as required above, is placed.

3.03 EXCESS OR UNSUITABLE EXCAVATION:

A. Dispose of excavation in excess of that needed or unsuitable for construction. As directed by the Engineer, excess or unsuitable excavation may be used for widening of embankments, or flattening of slopes, or as otherwise specified.

B. Obtain approval of the Engineer as to disposition and method for disposal of excess or unsuitable excavation.

3.04 GENERAL:

A. Provide all labor, equipment and associated materials to excavate areas specified.

PART 4 - MEASUREMENT AND PAYMENT

4.01 UNCLASSIFIED STREET EXCAVATION:

A. When listed as a separate contract pay item, unclassified street excavation, as authorized, shall be measured in its original position and the volume determined by the average end area method. All work performed shall be paid for at the contract bid price per cubic yard for unclassified street excavation.

B. When not listed as a separate contract pay item, unclassified street excavation shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract pay items.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required by the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02230 EXCAVATION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of excavating and properly utilization, or otherwise satisfactorily disposal of, all excavated materials, of whatever character, within the limits of work.

B. Excavation shall also consist of constructing, compacting, shaping and finishing of all earthwork in designated areas on the plans, as specified herein, and in conformity with the required line grades and typical cross sections or as directed by the Engineer.

C. When not otherwise included, this item shall include the work described in Section 2101 - Preparation of Right of Way, Section 2102 - Clearing and Grubbing, Section 2236 – Embankment and Section 2238 – Concrete Removal.

PART 2 - PRODUCTS

2.01 CLASSIFICATION: All excavations shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Prior to commencing this work, all erosion control and tree protection measures required shall be in place and all utilities located and protected.

B. Construction equipment shall not be operated within the drip line of trees, unless otherwise indicted.

C. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

D. All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections.

E. Suitable excavated materials shall be utilized, insofar as practical, in constructing required embankments.

F. The construction of all embankments shall conform to Section 2236 -

Embankment. No material shall be stockpiled within the banks of a waterway.

G. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. It shall become his sole responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

H. Adequate dewatering and drainage of excavation shall be maintained throughout the time required to complete the work.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Measurement of the volume of excavation in cubic yards by the average end areas. Cross sectional areas shall be computed from existing ground section to the established line of the subgrade, as shown on typical sections for the limits of the right-of-way or other work limits, including parkway slopes and sidewalk areas.

B. Measurement of the area in square yards of surface area excavated as shown on the typical sections included in the plans.

C. Measurement of the volume of excavation is in cubic yards, based upon the average end areas taken from pre-construction cross sections and planned grades. The planned quantities for excavation will be used as the measurement for payment for this item.

4.02 PAYMENT:

A. This item will be paid for at the contract unit price bid for "Excavation," as provided under the measurement method as included in the bid, which price shall be full compensation for all work herein specified: including dewatering, drainage, subgrade preparation, unless otherwise indicated and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

B. When not listed as a separate contract pay item, excavation shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02234 BORROW

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of required excavation, removal and proper utilization of materials secured from sources obtained by the Contractor and approved by the Engineer.

B. Borrow will only be used when indicated on the plans or as directed by the Engineer and then only from approved sources.

PART 2 - PRODUCTS

2.01 MATERIAL

A. All authorized borrow shall conform to one of the following classes:

1. Class A (Select Borrow): This material shall consist of sand and or other suitable granular material, free from vegetation or other objectionable matter reasonable free from lumps of earth and when tested by standard SDHPT laboratory methods, shall meet the following requirements:

   The Liquid Limits shall not exceed 45
   The Plasticity Index shall not be
   less than 4
   nor more than 15

2. Class B: This material shall consist of suitable non-swelling (soils with plasticity index less than 20) earth material such as loam, clay or other such materials that will form a stable embankment.

3. Topsoil: This material shall consist of approved topsoil material and shall be clean, friable soil capable of supporting plant life. This material shall also be free of stones and all other debris.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS:

A. Prior to commencing this work, all erosion control and environmental measures required shall be in place. All suitable materials removed from excavations shall be used, insofar as practicable in the formation of embankments conforming to Section 02226, Excavation, Backfill & Compaction for Pavement or otherwise be utilized as indicated or as directed by the Engineer and the complete work

shall conform to the established alignment, grades and cross section.

B. Additional material necessary to complete the work described above shall be "Borrow" of the class specified.

C. The Contractor shall arrange for borrow from one of the following sources:

1. Existing borrow pit.

2. New borrow pit.

3. Surplus excavated material from a site which has a site development permit.

D. The Contractor shall notify the Engineer three weeks prior to opening pit to permit necessary testing for approval of materials. All borrow sites shall comply with the requirements of the permit.

E. During construction, the borrow sources shall be kept drained, insofar as practicable, to permit final cross sections to be taken when required.

F. The Engineer shall be notified sufficiently in advance of opening any borrow source to permit necessary testing for approval of materials.

G. Borrow sites shall be managed to minimize the impact of the appearance of the natural topographic features and at no time create a potential hazard to the public.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Borrow will be measured by the cubic yard in its final position based on the average end areas method taken from plan cross-sections and plan grades.

B. The plan quantities will be used as the measurement of this item.

4.02 PAYMENT:

A. The accepted quantities of borrow will be paid at the contract unit bid price per cubic yard.

B. Payment for unauthorized work will not be made.

C. Prices bid shall be full compensation for furnishing all labor; for all materials; for all royalty and freight involved; for all hauling and delivering on the road; and for

all tools, equipment and incidentals necessary to complete the work.

END OF SECTION

SECTION 02236 EMBANKMENT

PART 1 GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of placing and compacting of suitable material obtained from approved sources for use in the construction of street or channel embankments, berms, levees, pikes and structures.

PART 2 – PRODUCTS

2.01 MATERIAL

A. All authorized borrow shall conform to one of the following classes:

1. Class A (Select Borrow): This material shall consist of sand and or other suitable granular material, free from vegetation or other objectionable matter reasonable free from lumps of earth and when tested by standard SDHPT laboratory methods, shall meet the following requirements:

The Liquid Limits shall not exceed	45
The Plasticity Index shall not be	
less than	4
nor more than	15

2. Class B: This material shall consist of suitable non-swelling (soils with plasticity index less than 20) earth material such as loam, clay or other such materials that will form a stable embankment.

3. Topsoil: This material shall consist of approved topsoil material and shall be clean, friable soil capable of supporting plant life. This material shall also be free of stones and all other debris.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION METHODS:

A. Prior to placing any embankment, all tree protection, tree wells and erosion control devices shall be in place and all Section 02101, Preparing Right of Way and/or Section 02102, Clearing and Grubbing operations shall have been completed on the areas over which the embankment is to be placed.

B. Stump holes or other small excavations in the limits of the embankments shall be backfilled with suitable materials and thoroughly tamped by approved methods before commencing embankment construction.

C. The surface of the ground, including plowed loosened ground or surface roughened by small washes, shall be restored to approximately its original slope and the ground surface thus prepared shall be compacted by sprinkling and rolling.

D. Construction equipment shall not be operated within the drip line of trees, unless indicated. Construction materials shall not be stockpiled under the canopies of trees.

E. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

F. Unless otherwise indicated, the surface of the ground of all unpaved areas, other than rock which are to receive embankment, shall be loosened by scarifying or plowing to a depth of not less than 4-inches.

G. The loosened material shall be recompacted with the new embankment as hereinafter specified.

H. The surface of hillsides to receive embankment shall be loosened by scarifying or plowing to a depth of not less than 4-inches and benches cut before embankment materials are placed.

I. The embankment shall then be placed in layers, as hereinafter specified, beginning at low side in partial width layers and increasing the width as the embankment is raised.

J. The material which has been loosened shall be recompacted simultaneously with the embankment material placed at the same elevation.

K. Where embankments are to be placed adjacent to or over existing roadbeds slopes shall be plowed or scarified to a depth of not less than 6-inches and the embankment built up in successive layers, as hereinafter specified, to the level of the old roadbed before its height is increased. Then, if indicated, the top of the old roadbed shall be scarified and recompacted with the next layer o the new embankment.

L. The total depth of the scarified and added material shall not exceed the permissible layer depth.

M. Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in embankment.

N. All embankment shall be constructed in layers approximately parallel to the finished grade and unless otherwise indicated, each layer shall be so constructed as to provide a uniform slope of 1/4 inch per foot from the centerline of the roadbed to the outside, except that on super-elevated

curves, each layer shall be constructed to conform to the super-elevation indicated.

O. The embankment shall be continuously maintained at its finished section and grade until that portion of the work is accepted.

P. After completion of the embankment to the finished section and grade, the CONTRACTOR shall proof roll the subgrade and revegetation procedures must commence immediately to minimize the soil loss and air pollution.

3.02 EARTHEN EMBANKMENTS:

A. Earth embankments shall be defined as embankments composed of soil material other than rock and shall be constructed of acceptable material from approved sources.

B. Except as otherwise indicated, earth embankments shall be constructed in successive 6-inch layers, loose measure, for the full width of the individual cross section and in such length as are best suited to the sprinkling and compaction methods utilized.

C. Minor quantities of rocks not larger than 4-inches, encountered in constructing earth embankment may be incorporated in the earth embankment layers, provided such placement of rock is not immediately adjacent to structures.

D. Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction.

E. Where layers of unlike materials about each other, each layer shall be feathered on a slope of 1:20 or the material shall be so mixed as to prevent abrupt changes in the soil.

F. No material placed in the embankment by dumping in a pile or windrows shall be incorporated in a layer in that position, but all such poles or windrows shall be moved by blading or similar methods.

G. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, deicing or similar methods to the end that a uniform density is secured in each layer.

H. Water required for sprinkling to bring the material to the moisture content necessary for optimum compacting shall be evenly applied and it shall the responsibility of the CONTRACTOR to secure a uniform moisture content throughout the layer by such methods a may be necessary.

I. All earth cuts, whether full width or partial width cuts in the side of a hill, which are not required to be excavated below subgrade elevation shall be scarified

to a uniform depth of at least 7-inches below grade and the material shall be mixed and reshaped by blading and then sprinkled and rolled in accordance with the requirements outlined above for earth embankments and to the same density as that required for the adjacent embankment.

J. Each layer shall be compacted to the required density by any methods, type and size of equipment which will give the required compaction.

K. Prior to and in conjunction with the rolling operation, each layer shall brought to the moisture content compaction over the entire layer.

L. For each layer of earth embankment and select materials, it is the intent of this specification to provide the density as required herein, unless otherwise indicated.

M. Soils shall be sprinkled as required and compacted to the extent necessary to provide not less than 95 percent nor more than 105 percent of the density as determined to accordance with SDHPT Test Method Tex-114-E at optimum moisture content or within minus 3 percent of the optimum moisture content.

N. Care shall be taken to avoid overcompacting high PI expansive clays.

O. After each layer of earth embankment or select material is complete, tests as necessary will be made by the ENGINEER. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction.

3.03 ROCK EMBANKMENTS:

A. Rock embankments shall be defined as those composed principally of rock and shall be constructed of accepted material from approved sources. Rock embankments shall not be placed immediately adjacent to structures.

B. Except as otherwise indicated, rock embankments shall be constructed in successive layers for the full width of the cross section and of 18 inches or less in depth.

C. When, in the opinion of the ENGINEER, the rock sizes necessitate a greater depth of layer than specified, the layer depth may be increased as necessary, but in no case shall the depth of layer exceed 2 1/2 feet.

D. Each layer shall be constructed by starting at one end and dumping the rock on the top of the layer being constructed then pushing the material ahead with a bulldozer in such a manner that the larger rock will be placed on the ground or preceding embankment layer and the interstices between the larger stones

and spalls by the operation and from the placing of succeeding loads of material.

E. The maximum dimension of any rock used in embankment shall be less than the depth of the embankment layer and in no case shall any rock over 2 feet in its greatest dimension be placed in the embankment.

F. All oversized rocks which are otherwise suitable for construction shall be broken to the required dimension and utilized in embankment construction where indicated, except that when preferred by the CONTRACTOR and acceptable to the ENGINEER, such rocks and may be placed at other points where the embankment layer is of greater depth, thus requiring less breakage.

G. Each layer shall be compacted to the required density as outlined for "Earthen Embankments", above, except in those layers where rock will make density testing difficult, the ENGINEER may accept the layer by visual inspection or proof rolling.

H. Unless otherwise indicated, the upper 3 feet of the embankment shall contain no stones larger than 4 inches in their greatest dimension and shall be composed of material so graded that the density and uniformity of the surface layer may be secured in accordance with SDHPT Test ` Method Tex-114-E.

I. Exposed oversize material shall be broken up or removed.

3.04 EMBANKMENT AT CULVERTS AND BRIDGES:

A. Embankments adjacent to culverts and bridges which cannot be compacted by use of the blading and rolling equipment used in compacting the adjoining sections of embankment shall be compacted in the manner prescribed under Section 02221, Trench Excavation Backfill and Compaction.

B. Embankment placed around spill through type abutments shall be constructed in 6 inch loose layers of uniform suitable material placed in such manner as to maintain approximately the same elevation on each side of the abutment and all materials shall be mixed, wetted and compacted as specified above.

C. Embankment material placed adjacent to any portion of any structure or above the top of any culvert or similar structure shall be free of any appreciable amount of gravel or stone particles and thoroughly compacted by mechanical compaction equipment.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. All accepted embankment, when included in the contract as a separate bid item, will be measured in place and the volume computed in cubic yards by the method of average end areas.

B. No allowance will be made for shrinkage. No additional pay for swelling.

4.02 PAYMENT;

A. The accepted quantities of embankment, when included as a separate bid item, will be paid at the contract unit bid price per cubic yard.

B. When not listed as a separate contract pay item, embankment shall be considered as incidental work, and the cost thereof shall included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing al materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02240 LIME STABILIZATION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. Treating of subgrade, subbase, and base courses by the pulverization, addition of lime, mixing and compacting the mixed material to the required density.

B. Application to natural ground, embankment, existing pavement, base or subbase under this contract, or as directed by the ENGINEER, which shall be constructed as specified herein and in conformity with the typical section, lines, grades as shown on the plans.

1.02 QUALITY ASSURANCE:

A. Comply with the latest published edition (or addended portions thereof) of the following standards and codes:

1. ASTM C—207 or Type N — Requirements for Hydrated Lime
2. ASTM Designation C5 — Quick Lime for Structural Purposes
3. Texas SDHPT Test Method Tex—600—J - Hydrated Lime
4. ASTM D—1557 - Density of Compacted Materials
5. ASTM D-2049 - Density of Compacted Materials
6. Texas SDI-IPT Test Method Tex 113—E — Density of Compacted Materials
7. AASHTO T—99, Method C - Density of Compacted Materials
8. AASHTO M-216 - Hydrated Lime

PART 2 - PRODUCTS

2.01 HYDRATED (DRY) LIME:

A. Use, for stabilization of soils, a dry powder consisting primarily of calcium hydroxide ($Ca(OH)_2$).

B. Provide Material in accordance with Texas SDHPT Test Method TEX— 600—J and conforming to the following chemical composition:

Hydrate Alkalinity, Percent by Weight $Ca(OH)_2$ 90% Min. Unhydrate Lime Content, Percent by Weight CaO 5% Max. “Free Water” Content, Percent by Weight H_20 4% Max.

And with the following residue retainage:

Residue Retained on No. 6 Sieve	None
Residue Retained on No. 10 Sieve	1% Max.
Residue Retained on No. 30 Sieve	2.5% Max.

C. Store and handle hydrated lime in closed, weather proof containers, storage bins, or bags until immediately before application to the road.

D. Furnish hydrated lime in trucks, as applicable, with weight of lime measured on certified scales and clearly marked on the truck or stamped on a haul ticket.

E. Furnish hydrated lime in bags, as applicable, bearing the manufacturer's certified weight. Bags varying more than five percent may be rejected.

2.02 HYDRATED LIME SLURRY:

A. Provide a pumpable suspension of solids, principally composed of hydrated lime, in water.

B. Provide material with a "Solids Content" having a hydrated alkalinity $Ca(OH)_2$ of not less than 90 percent by weight and a residue retainage equal to the retainage specified in Part 2.01B above.

C. Supply Type B, commercial lime slurry, with a "dry solids content" of at least 31% by weight of the slurry (Grade 1).

D. Procure mixing water only from City of Edinburg water mains. The Contractor shall make arrangements with the City Water Department to obtain a meter and subsequent payment for water used.

2.03. QUICKLIME (MASON'S LIME):

A. Provide quicklime, as a dry powder in a tank, to form a lime slurry.

PART 3 - EXECUTION

3.01 GENERAL:

A. Provide a completed course of treated materials containing a uniform lime mixture, free from loose or segregated areas, of required density and moisture content, well bound for its full depth, and with a smooth surface and suitable for placement of subsequent courses.

B. Regulate sequence work, use proper amounts of lime, maintain the work and rework the courses as necessary to meet the requirements of this specification.

C. Construct and shape smooth roadbed to conform to typical sections, lines and grades as shown on the plans, or as directed by the ENGINEER.

D. Excavate materials to be treated to the proposed bottom of lime treatment grade, or secondary grade and remove or windrow to expose secondary grade.

E. Correct any wet or unstable material below the secondary grade by scarifying, adding lime and compacting until uniform stability is achieved.

F. Use a cutting or pulverizing machine, as applicable, to remove subgrade material accurately to secondary grade and to pulverize the material at the same time. When cutting or pulverizing machine is used, the requirement for exposing and windrowing the material is waived.

G. Roll subgrade before use of pulverizing machinery and correct any soft areas that rolling operations shall reveal.

H. Materials for new base and subbase shall be delivered, placed and spread in the required amount per station. The material shall be thoroughly mixed prior to the addition of lime.

I. Lime shall be spread only on that area where first mixing operation can be completed in the same working day.

3.02 SLURRY PLACING:

A. Mix lime, in amounts as shown on plans, or as specified by the Materials Engineering Laboratory, with water in trucks or approved distributors and apply as a thin water suspension or slurry. Provide slurry free of objectionable materials.

B. The distribution of lime at the rates shown on the plans, as directed herein, and/or as directed by the ENGINEER, shall be attained by uniformly successive passes over a measured surface of roadway until the proper moisture and lime content is achieved.

C. Lime slurry distributors shall be equipped with an agitator for maintaining lime and water in a uniform mixture.

3.03 DRY PLACING:

A. Before applying lime, bring the prepared roadway to approximately optimum moister content. Spread lime by an approved screw type spreader box or by bag distribution at the required rate shown in the plans.

B. Distribute lime at a uniform rate with approved equipment and in such a manner as to reduce scattering of lime to a minimum. Lime shall not be applied when wind conditions, in the opinion of the ENGINEER, will cause objectionable blowing of lime to traffic or adjacent properties.

C. Only hydrated lime may be distributed by bag. Motor graders shall not be used to spread hydrated lime.

D. Sprinkle material until required lime content has been secured.

3.04 MIXING:

A. Mixing procedures shall be the same for “Dry Placing” or “Slurry Placing” or lime.

B. Treatment for Materials in Place:

1. Thoroughly mix material and lime using approved road mixers or other approved equipment, until a homogeneous, friable mixture of material is obtained, free from all clods and lumps.

2. Mix as thoroughly as possible at the time of lime application of materials containing plastic clay or other materials not readily mixed with lime, bring to proper moisture content, seal with a pneumatic roller, and leave to cure one to four days, as directed by the ENGINEER.

3. During curing period, material shall be kept moist by method(s) approved by the ENGINEER.

4. Uniformly mix, after required curing time, using approved methods.

5. Clods in soil binder - Lime mixture shall be reduced in size by raking, blading, discing, harrowing, and scarifying or by other approved pulverization methods such that nonslaking aggregates obtained on the No. 4 sieve are removed. The remainder of the material shall meet the following requirements when test dry by laboratory sieves:

Minimum Passing 1 3/4 inch	100%
Minimum Passing No. 4 Sieve	60%

C. Treatment of New Material

1. Thoroughly mix and blend, using approved road mixers or other approved equipment, the base or subbase material, lime and required water until a homogeneous, friable mixture is obtained.

2. When lime is placed as slurry and mixed by use of blades, the material shall be bladed as the limewater mixture is applied.

D. During the time between application and mixing, hydrated lime that has been exposed to the open air for a period of six hours or more, or to excessive loss due to washing or blowing, shall not be accepted for payment.

3.05 COMPACTION:

A. Compaction of the mixture shall begin immediately after final mixing and in no case later than three calendar days after final mixing.

B. Aerate or sprinkle material as required to provide optimum moisture.

C. Compaction shall begin at the bottom and shall continue until entire depth of mixture is uniformly compacted to 95% of maximum density as determined by AASHTO T-99, Method C.

D. If any portion fails to meet the density specified, it shall be reworked as required to obtain specified density.

3.06 FINISHING, CURING, AND PREPARATION FOR SURFACING:

A. Shape surface after compaction to the required lines, grades, and cross sections, followed by thorough rolling sufficiently light to prevent hair-line cracking.

B. Complete sections shall be moist cured for a minimum of two days before further coursed are added or any traffic permitted, other than sprinkling equipment.

C. The surface or compacted layer shall be kept moist until covered by other base or paving material, or until an application of CSS-1 or 55-1 emulsified asphalt as a curing seal. Curing seal shall be applied as soon as possible after final rolling at a rate of 0.05 to 0.20 gallons per square yard. The exact rate will be as directed by the ENGINEER.

D. No equipment or traffic will be permitted on lime treated materials for 72 hours after application of curing seal.

3.07 MAINTENANCE:

A. Maintain the completed lime treated material within the limits of contract, in condition satisfactory to the ENGINEER as to grade, crown and cross section until surface course is constructed.

B. Immediately repair all irregularities and defects that may occur at no cost to the City of Edinburg of Edinburg and as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. When included as a separate line item, lime treatment may be measured for payment in square yards for the thickness of material shown on the plans for the surface area of completed and accepted work or lime will be measured by the ton of 2,000 pounds dry weight. Lime treatment shall be paid for at the contract unit price per square yard or paid at the contract unit cost per ton of 2,000 pounds dry weight.

B. When not included as a separate line item, lime treatment shall be considered incidental to the completion of construction and the costs thereof shall be included in the line items provided.

C. The contract unit price for lime treatment shall be the total compensation for preparing roadbed; for loosening, pulverizing, application of lime, water content of slurry mixture and the mixing water; mixing, shaping, sprinkling, compacting, finishing, curing and maintaining; for manipulations required, for all labor, equipment, fuels, tools and incidentals necessary to complete the work.

D. The contract unit price for lime shall be full compensation for furnishing the material; for all freight involved; for all unloading, storing and hauling; and for all labor, equipment, fuels, tools, and incidentals necessary to complete the work.

END OF SECTION

SECTION 02936 SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Placing Topsoil and/or Preparation of Subsoil

B. Fertilizing

C. Seeding

D. Mulching

1.02 PAYMENT

A. Payment for seeding will be made at the Contract Unit Price shown on the Bid Form and will be full compensation for completing all Work specified in this Section including materials and placement of topsoil and/or preparation of subsoil, fertilizer, seed, mulch, watering and maintenance, etc.

B. Payment is based on field measurements of the area seeded as specified on the Drawings.

1.03 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.06 MAINTENANCE

A. Continue watering newly seeded area to provide optimum growth conditions for the duration of the Contract Time and in no case less than 2 weeks.

B. Mow the grassed (by seeding) area when the vegetation's height exceeds 8 inches.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Muck; free of plants, weeds and roots. PH level between 5.0 and 7.0. Organic content of at least 1.5 percent.

B. Seed: All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS = purity x germination), name and type of seed. The species and varieties of seed shall be from among the types specified in TxDOT Specifications, Item 164, Table 1A.

C. Fertilizer: 12 percent nitrogen - 8 percent phosphoric acid - 8 percent potash.

D. Water: Free of excess and harmful chemicals, acids, alkalies, or any substance which might be harmful to plant growth. Salt water not permitted.

E. Dry Mulch: Shall be straw or hay. Straw mulch shall consist of oat, wheat, or rice straw. Hay mulch shall be prairie grass, bermudagrass or other has as approved by the ENGIEER. Use only undeteriorated mulch which can be readily cut into the soil. All mulch shall comply with TxDOT Specifications, Item 163.2(4).

PART 3 EXECUTION

3.01 INSTALLATION

A. All seeding and mulching shall be done in accordance with TxDOT Specifications, Item 163 or as otherwise specified in these specifications.

3.02 INSPECTION

A. Determine whether the existing soil base is of a material that would be favorable to plant growth. If the soil is not favorable, then placement of topsoil is required.

3.03 PLACING TOPSOIL

A. Spread topsoil to a minimum thickness of 2 inches over the entire area to be seeded.

B. Place topsoil during dry weather.

C. Roto-till to a depth of 6 inches.

D. Fine grade the area to be seeded to eliminate ridges, depressions and other irregularities, and to ensure positive drainage.

3.04 FERTILIZING

A. All fertilizer (materials and installation) shall comply with TxDOT Specifications, Item 166.

B. Fertilizing operations will not be permitted when wind velocities exceed 15 miles per hour.

B. Apply fertilizer uniformly at a rate of 400-500 pounds per acre.

C. Apply after smooth raking of topsoil and prior to seeding.

D. Supply fertilizer no more than 48 hours before seeding.

E. Lightly water to aid the dissipation of fertilizer.

3.05 SEEDING

A. Seeding operations will not be permitted when the wind velocities exceed 15 miles per hour.

B. Seed only when the soil is moist and in proper condition to induce growth.

C. Spread seed at a rate of 100 pounds per acre.

D. If seeding is accomplished during the period from 15 September to 15 January, add rye seed to the mixture at the rate of 20 pounds per acre for a total rate of 100 pounds for the mixture of rye and bahia.

E. Immediately after completion of the seeding, roll entire seeded area. At least two trips over the entire area are required.

F. Newly seeded areas are not be watered to force seed germination but only to sustain grass growth.

3.06 MULCHING

A. Immediately following seeding and rolling, apply mulch to a loose thickness of 1 inch over the entire seeded area.

B. Apply water with a fine spray immediately after each area has been mulched.

END OF SECTION

SECTION 09101 CONSTRUCTION TRAFFIC CONTROL

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This item shall consist of the construction, manipulation, maintenance and removal, if required, of detours of the length and to the lines, grades, and typical sections indicated and providing for installing, moving, replacing, maintaining, cleaning and removing upon completion of the work, as required, all detour markers, signs, barricades and other devices used in traffic control and handling at the construction site as indicated or as directed by the ENGINEER.

B. CONTRACTOR shall be responsible for submittal of a traffic control plan sealed by a registered professional engineer in the state of Texas prior to the start of construction. CONTRACTOR shall be responsible for all traffic control measures and implementation. All proposed routing of traffic must be approved in writing prior to implementation. All traffic control devices shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD), latest edition.

C. This item shall also consist of providing, installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated or directed by the ENGINEER.

D. Implementation. Before beginning work, designate in writing a Contractor's Responsible Person (CRP) to be the representative of the Contractor who is responsible for taking or directing corrective measures of installation and maintenance deficiencies as soon as possible. The CRP must be accessible by phone and able to respond to emergencies 24 hours per day.

E. Follow the Traffic Control Plan (TCP) and install traffic control devices as shown on the plans and as directed. Install traffic control devices straight and plumb. Do not make changes to the location of any device or implement any other changes to the TCP without the approval of the Engineer. Minor adjustments to meet field constructability and visibility are allowed.

F. Submit Contractor-proposed TCP changes, signed and sealed by a licensed professional engineer, to the Engineer for approval. The Engineer may develop, sign, and seal Contractor-proposed changes. Changes must conform to guidelines established in the TMUTCD using approved products

from the Texas DOT Compliant Work Zone Traffic Control Device List (CWZTCDL).

G. Maintain traffic control devices by taking corrective action as soon as possible. Corrective action includes but is not limited to cleaning, replacing, straightening, covering, or removing devices. Maintain the devices such that they are properly positioned, spaced, and legible, and that reflective characteristics meet requirements during darkness and rain.

H. Flaggers. Provide a Contractor representative who has been certified as a flagging instructor through courses offered by the Texas Engineering Extension Service, the American Traffic Safety Services Association, the National Safety Council, or other approved organizations. Provide the certificate indicating course completion when requested. This representative is responsible for training and assuring that all flaggers are qualified to perform flagging duties. A qualified flagger must be independently certified by one of the organizations listed above or trained by the Contractor's certified flagging instructor. Provide the Engineer with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list. Flaggers must be courteous and able to effectively communicate with the public. When directing traffic, flaggers must use standard attire, flags, signs, and signals and follow the flagging procedures set forth in the TMUTCD.

I. Removal. Upon completion of work, remove all barricades, signs, cones, lights, and other traffic control devices used for work-zone traffic handling, unless otherwise shown on the plans.

PART 2 - PRODUCTS

2.01 CONSTRUCTION TRAFFIC CONTROL SIGNS:

A. Construction traffic control signs shall conform to the State of Texas DOT Manual of Uniform Traffic Control Devices, Parts 5 & 6 unless otherwise directed by the ENGINEER.

B. The substrate for construction signs need only be sufficiently durable to last the life of the project and sufficiently rigid to hold the sheeting in a flat plane.

2.02 SIGN SUPPORTS:

A. Supports for construction traffic control signs shall be grade #2 fir or yellow pine, pressure treated with pentachlorophenol.

B. Supports shall have a minimum nominal size of 4-inches x 4-inches and conform to the details shown on the plans.

2.03 PORTABLE SIGN SUPPORT:

A. Materials for portable sign supports shall comply with the details shown on the plans. Portable sign supports other than those shown on the plans shall be submitted to the ENGINEER for approval prior to use.

2.04 BARRICADES:

A. Barricades shall be classified as Type I, Type II, or Type III and shall comply with the details shown on the plans and the TMUTCD.

B. Barricade rails shall be fabricated using grade #2 fir or yellow pine and reflectorized sheeting conforming to the requirements shown in Section 2.08(5).

2.05 VERTICAL PANELS:

A. Materials for vertical panels shall conform to the details shown on the plans. Vertical panels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements of the TMUTCD and Table 9000-3.

2.06 CONSTRUCTION TRAFFIC MARKINGS:

A. Construction traffic markings shall comply with Section 9101 and the details shown in the plans.

2.07 ABBREVIATED PAVEMENT MARKINGS FOR CONSTRUCTION:

A. The pavement-marking material shall consist of an adhesive-backed reflective tape that can be applied to the pavement. Markings shall be of good appearance, have straight, unbroken edges and have a color that complies with all federal regulations.

1. Color

a) The markings, as well as retroreflected light from the markings, shall be white or yellow as indicated.

2. Visibility

a) The pavement markings (during daylight hours) shall be distinctively visible for a minimum of 300 feet unless sight distance is restricted by geometric roadway features.

b) The pavement markings (when illuminated by automobile low beam headlights at night) shall be distinctly visible for a minimum of 160 feet unless sight distance is restricted by geometric features.

c) The above day and night visibility requirements shall be met when viewed from an automobile traveling on the roadway.

2.08 CHANNELIZATION DEVICES:

A. Barrels

1 Barrels shall be of metal or nonmetal composition approved by the ENGINEER and of 30 to 55 gallon capacity. Only one size may be used on the project. The barrels shall be reflectorized with orange and white reflective sheeting or tape in accordance with the requirements of TMUTCD. The markings on the barrels shall be horizontal, circumferential, orange, and wide. There shall be a minimum of 5 alternating orange and white stripes on each barrel. Barrels shall also conform to the details shown on the plans.

2. Type "B" barrels shall be equipped with either Type "A" low intensity or Type "C" steady-burn warning lights complying with the provisions to TMUTCD and the Institute of Transportation Engineers (ITE) standard for flashing and steady-burn lights. The use of warning lights shall be as directed by the ENGINEER.

B. Traffic Cones

1. Traffic cones shall conform to the details shown on the plans.

C. Tubular Traffic Markers

1. Post

a) The post shall be of a thermoplastic or pliable elastomeric composition meeting the manufacturer's requirements.

b) Properties:

Outside Diameter……..2.23 inches to 4 inches

Wall Thickness…….0.125 inches min.
Length……....18 to 36 inches
Color……...Orange

2. Base

a) The base shall be of a thermoplastic or pliable elastomeric composition meeting the manufacturer's requirements.

b) Properties:
Height:……1/2 to 2 inches
Outside Diameter:… 7 to 12 inches
Color: ……..black or same color as post

3. Assembly Units

a) Assembly units which are inherent with the particular marker shall be as per manufacturer's recommendations.

4. Adhesives

a) Adhesive shall be epoxy type (temporary installation, permanent installation or butyl type) as per manufacturer's recommendations.

b) Other methods approved by the ENGINEER prior to initiating the work may be used; however, said approval does not abrogate the CONTRACTOR'S responsibility of effecting the temporary or permanent installation.

5. Reflectorization

a) If used at night, tubular traffic markers shall have two 3-inch, circumferential reflective bands, no more than 2-inches from the top with no more than 6-inches separating the bands. Reflective material shall be SIA-250 or higher sheeting conforming to the provisions of Section 9000. The color of reflective material shall be as shown in the plans.

2.09 SEQUENTIAL ARROW DISPLAYS

A. Sequential arrow displays shall be sequentially lighted and roof or trailer mounted. The minimum panel size shall be 30-inches high an 54-inches wide. The display shall have 22 hooded sealed beam amber lamps rated at a maximum intensity of 8800 candlepower.

B. Light intensity shall be adjustable by dimmer switch. The operating modes shall be as follows:

1 Pass Left. 3 chevrons of 5 lamps each sequence in right to left pattern, 40 to 50 times per minute.

2 Pass Right. 3 chevrons of 5 lamps each sequence in left to right pattern, 40 to 50 times per minute.

3 Pass Either Side. The two outermost chevrons on each end of the panel pointing like arrowheads and flashing 40 to 50 times per minute with crossing row of lamps burning continuously.

4 Warning. 4 lamps, one at each corner of the panel, flashing 40 to 50 times per minute.

2.10 MATERIALS FOR CONSTRUCTION DETOURS

A. Flexible Base

1. Flexible base shall conform to Section 02601.

B. Prime Coat

1. Prime Coat shall conform to Section 02610.

C. Seal Coat

1. Seal Coat shall conform to Section 02617.

D. Hot Mix Asphaltic Concrete Pavement

1. Hot Mix shall be Type D conforming to Section 02612.

E. Seeding

1. Seeding shall conform to Section 02936.

PART 3 - EXECUTION

3.01 CONSTRUCTION TRAFFIC CONTROL SIGNS AND SIGN SUPPORTS:

A. Construction traffic control signs and sign supports shall be installed at locations noted on the plans in conformance with the TMUTCD or as directed by the ENGINEER.

3.02 PORTABLE SIGN SUPPORTS:

A. Portable sign supports for traffic control devices for detours shall be furnished by the CONTRACTOR or shall be installed at the locations shown on the plans, and shall remain the property of the CONTRACTOR.

B. Unless otherwise specified, portable sign supports shall be of the dimensions shown on the plans.

3.03 BARRICADES:

A. Barricades shall be installed in conformity with the details noted on the plans or as directed by the ENGINEER.

3.04 VERTICAL PANELS:

A. Vertical panels shall be installed in conformity with the details noted on the plans or as directed by the ENGINEER.

3.05 CONSTRUCTION TRAFFIC MARKINGS:

A. Construction traffic markings shall be installed in conformity with TxDOT MUTCD, Part 5, Section 5E.01 and the details shown on the plans or as directed by the ENGINEER.

3.06 ABBREVIATED PAVEMENT MARKING FOR CONSTRUCTION:

A. Abbreviated markings meeting all specification requirements shall be in place on all roadways on which traffic is allowed and where suitable standard pavement marking is not in place. The transverse location of the line(s) formed by the markings shall be as determined by the ENGINEER.

B. Unless otherwise indicated, the abbreviated markings shall be placed as follows:

Condition	**Spacing**	**Length of Stripe**
Straight	40 feet approximately	48 inch
Curve greater than 2 degrees	20 feet maximum	48 inch
Curve less than or equal 2 degrees	40 feet maximum	48 inch

C. Pavement markings shall be a minimum of 3-7/8 inches wide. Length and spacing will be in accordance with these specifications.

D. The spacing of stripes may be modified by the ENGINEER. However, the maximum spacing specified above shall not be exceeded in any case.

E. The CONTRACTOR will be responsible for maintaining the abbreviated pavement markings until standard pavement markings are in place.

F. Abbreviated pavement markings shall be removed after all permanent markings have been placed.

3.07 CHANNELIZATION DEVICES:

A. Type "A" Barrels

1. Type "A" barrels shall be used during daylight hours only and shall not be equipped with warning lights of any type. The term "daylight hours" refers to those hours between dawn and dusk.

B. Type "B" Barrels

1. Type "B" barrels shall be equipped with warning lights. Type "B" barrels shall be used during nighttime hours only, unless otherwise shown on the plans or directed by the Project Manager. The term "nighttime hours" refers to those hours between dusk and dawn.

C. Traffic Cones

1. Traffic cones shall be installed in conformity with the plans and the TMUTCD or as directed by the ENGINEER.

D. Tubular Traffic Markers

1. The metal, concrete, or bituminous surface where the tubular traffic markers are to be placed shall be thoroughly cleaned.

2. Metal and concrete surfaces shall be sandblasted or wire brushed. Bituminous surfaces shall be cleaned in accordance with manufacturer's recommendations.

3. All loose sand, dust and other deleterious debris from cleaned mounting surfaces shall be removed.

4. Tubular traffic markers shall be installed in conformity with details and at locations shown on the plans or as directed by the ENGINEER and in accordance with the manufacturer's recommendation.

5. In the event that removal of an installation (temporary or permanent) is effected and the metal, concrete, or bituminous surface is damaged the CONTRACTOR shall repair and otherwise restore said surface to its original condition at no additional cost to the City.

6. All defective post(s), base(s), assembly unit(s), adhesive(s), or reflective sheeting contributing to the detriment of the intended function of the tubular traffic markers shall be replaced by the CONTRACTOR at no additional cost to the City.

E. Channelization devices shall be installed and of the type in accordance with the details shown on the plans. Barrels shall be as noted herein.

3.08 SEQUENTIAL ARROW DISPLAY:

A. Sequential arrow displays shall be used according to the requirements shown on the plans and as shown in TxDOT MUTCD.

3.09 CONSTRUCTION DETOURS:

A. The detours shall be constructed at the locations and to the lines and grades indicated. It shall be the entire responsibility of the CONTRACTOR to provide for the passage of traffic in comfort and safety without creating a dust problem.

3.10 CONSTRUCTION METHODS:

B. Prior to commencing construction, suitable "Construction Traffic Control" devices shall be installed to protect the workers and the public.

C. The CONTRACTOR shall be responsible for installing all markers, signs and barricades conforming to The Texas Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the ENGINEER, additional markers, signs or barricades are needed in the interest of safety, the CONTRACTOR will install such as are required or as directed by the ENGINEER.

3.11 MAINTENANCE:

A. It shall be the CONTRACTOR’S responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be

constructed as required after the completion of the streets by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached.

B. When no longer needed, all temporary barricades, signs and traffic handling devices shall be removed and the area restored to its original condition or as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Measurement of various items described in this specification, complete in place, will be made as follows:

1. Construction traffic control sign assemblies, consisting of the applicable signage mounted on either sign supports or portable sign supports, shall be measured per each or lump sum.

2. Barricades shall be measured by the type per each.

3. Vertical panels shall be measured per each. Supports required for vertical panels will not be measured for payment but will be considered incidental to the completion of the work.

4. Construction traffic markings shall be measured per linear foot.

5 Abbreviated pavement markings for construction shall be measured per linear foot.

6 Channelization devices shall be measured per each for the category and type shown.

7. Sequential arrow display shall be measured per each.

8. Construction detours shall be measured per each or considered incidental to completion of construction.

9. Construction traffic control plan, consisting of any or all of the items described herein, shall be measured lump sum or incidental to completion of construction.

4.02 PAYMENT:

A. The accepted quantities of construction traffic control devices shall be paid at the contract unit bid price per the unit of measurement noted above or as noted on the bid proposal.

B. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 09102 FILTER FABRIC

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of furnishing and placing of the materials for placing filter fabric as indicated or directed by the Engineer.

B. The filter fabric shall have the capacity of passing ground water without the transportation of soil placed around the filter fabric.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General

1. The fabric shall be constructed exclusively of synthetic thermoplastic fibers and may be either woven or non-woven to form a mat of uniform quality.

2. Fabric fibers may be either continuous or discontinuous and oriented in either a random or an aligned pattern throughout the fabric.

3. The fabric shall be mildew resistant, rot proof, shall be satisfactory for use in a wet soil and aggregate environment, contain ultraviolet stabilizers and have non-ravelling edges.

B. Physical Requirements

1. The fabric shall meet the following requirements when sampled and tested in accordance with the methods indicated in table below.

Fabric Requirements		
Physical Property	**Test Method**	**Requirement**
Tensile Strength, N (lb.)	ASTM D 4632	445 (100) Minimum
Elongation @ Yield, %	ASTM D 4632	10-40
Trapezoidal Tear, N (lb.)	ASTM D 4533	222 (50) Minimum
Apparent Opening Size	ASTM D 4751	20-50
Permittivity, 1/sec	ASTM D 4491	0.1 Minimum

Ultraviolet Stability original tensile strength retained after 500 hrs. exposure,%	ASTM D 4355	80 Minimum

2. All materials shall be shipped with suitable wrapping to protect the fabric during shipping and storage at the job site.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Catalog cuts, samples of material selected and the manufacturer's certification of compliance with the specification shall be submitted for review before any materials are ordered.

B. The "Filter Fabric" shall be installed in accordance with the manufacturer's recommendations, as indicated or as directed by the Engineer.

C. When lapping is required, it shall be in accordance with the manufacturer's recommendations.

D. Backfilling around the Filter Fabric shall be done in such a way as not to damage the Filter Fabric material during the placement.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Work and acceptable material for "Filter Fabric" will be measured by the square yard, complete in place.

4.02 PAYMENT:

A. The accepted quantities of filter fabric shall be paid for at the contract unit price per square yard in place.

B. When not listed as a separate contract pay item, filter fabric shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provide in the proposal contract.

C. Compensation, whether by contract pay items or incidental work will be for furnishing all materials, labor, equipment, tools, and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

Item 156
Bulldozer Work

1. DESCRIPTION

Excavate, remove, use, or dispose of materials using a bulldozer. Construct, shape, and finish earthwork in conformance with the required lines, grades, and typical cross-sections as shown on the plans, or as directed.

2. EQUIPMENT

Use a tractor, crawler, or rubber-tired type equipment with a blade attachment at least 8 ft. long. Use a scarifier or ripper with the required tractor when necessary. Use equipment of the type specified on the plans, in conformance with the following requirements.

2.1. **Type A**. Manufacturer's rated net flywheel power of less than 150 horsepower based on Society of Automotive Engineers (SAE) standard J1349.

2.2. **Type B**. Manufacturer's rated net flywheel power of 150 or greater horsepower based on SAE standard J1349.

3. CONSTRUCTION

Perform bulldozer work on the areas as specified on the plans, using equipment as specified above. Rough-in with bulldozer work where plans designate "Bulldozer Work" and "Blading," or "Road Grader Work," within the same limits. Finish in conformance with specifications for "Blading" or "Road Grader Work." Compact embankment to ordinary compaction in accordance with Item 132, "Embankment," unless otherwise shown on the plans.

4. MEASUREMENT

This Item will be measured by the actual number of hours of use of the specified type of equipment operated.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Bulldozer Work." This price is full compensation for furnishing and operating equipment, labor, materials, tools, and incidentals.

"Sprinkling" and "Rolling" will not be measured or paid for directly but will be subsidiary to this Item. Work performed under this Item will not include work specified for payment under other Items.

Item 158
Specialized Excavation Work

1. DESCRIPTION

Excavate, remove, use, or dispose of materials for erosion control or other specialized needs. Construct, shape, and rough-in earthwork as shown on the plans, or as directed.

2. EQUIPMENT

Use equipment of the type shown on the plans unless otherwise approved. Use equipment that can consistently and efficiently produce the desired results.

2.1. **Dragline**. Self-propelled dragline with a minimum 1/2-cu. yd. bucket.

2.2. **Backhoe**. Tractor-mounted backhoe capable of excavating a trench at least 12 in. wide in one pass.

2.3. **Hydraulic Excavator**. Hydraulic excavator with a retractable, telescoping, rotatable boom attached to an interchangeable excavating or grading bucket at least 36 in. wide. The entire excavating mechanism must be mounted on a platform that rotates on a turntable assembly.

2.4. **Front-End Loader**. Tractor-mounted front-end loader with a minimum bucket capacity of 1-1/4 cu. yd.

3. CONSTRUCTION

Perform “Specialized Excavation Work” on the areas shown on the plans or as directed. Use suitable excavated materials, including topsoil, for constructing the required roadway sections. Compact material placed in embankment to ordinary compaction in accordance with Article 132.3., “Construction,” unless otherwise shown on the plans. Accept ownership of all excavated material unless otherwise shown on the plans. Stockpile materials designated salvageable at designated sites. Properly dispose of excess excavated material in conformance with local, state, and federal requirements at locations outside the right of way.

4. MEASUREMENT

This Item will be measured by the hour of work performed for specified equipment or by the cubic yard. Measurement by the cubic yard will be further defined as follows.

4.1. **Original**. The cubic yard will be measured in its original position as computed by the method of average end areas or as shown on the plans.

4.2. **Vehicle**. The cubic yard will be measured in vehicles at the point of excavation.

5. PAYMENT

The work performed in accordance with this Item and measured by the hour as provided under “Measurement” will be paid for at the unit price bid for “Specialized Excavation Work” of the equipment type specified, or, for cubic yard measurement, payment will be made at the unit price bid for “Specialized Excavation Work (Original)” or “Specialized Excavation Work (Vehicle).” This price is full compensation for hauling and disposing or stockpiling of excess materials and for equipment, labor, materials, tools, and incidentals.

"Sprinkling" and "Rolling" will not be paid for directly but will be subsidiary to this Item. Work performed under this Item will not include work specified for payment under other Items.

Item 351
Flexible Pavement Structure Repair

1. DESCRIPTION

Repair localized sections of flexible pavement structure including subgrade, base, and surfacing as shown on the plans.

2. MATERIALS

Furnish materials unless otherwise shown on the plans. Provide materials of the type and grade as shown on the plans and in accordance with the following.

- Item 132, “Embankment”
- Item 204, “Sprinkling”
- Item 247, “Flexible Base”
- Item 260, “Lime Treatment (Road-Mixed)”
- Item 263, “Lime Treatment (Plant-Mixed)”
- Item 275, “Cement Treatment (Road-Mixed)”
- Item 276, “Cement Treatment (Plant-Mixed)”
- Item 292, “Asphalt Treatment (Plant-Mixed)”
- Item 310, “Prime Coat”
- Item 316, “Seal Coat”
- Item 330, “Limestone Rock Asphalt Pavement”
- Item 334, “Hot-Mix Cold-Laid Asphalt Concrete Pavement”
- Item 340, “Dense Graded Hot-Mix Asphalt (Small Quantity)”

For asphalt concrete materials, Contractor testing and payment adjustment provisions will be waived unless otherwise shown on the plans.

3. EQUIPMENT

Furnish equipment in accordance with pertinent Items. Use of a motor grader will be permitted for asphalt concrete pavement unless otherwise shown on the plans.

4. WORK METHODS

Repair using one or more of the following operations as shown on the plans. For Contracts with callout work, begin physical repair within 24 hr. of notification unless otherwise shown on the plans. Cut neat vertical faces around the perimeter of the work area when removing pavement structure layers. Removed materials are the property of the Contractor unless otherwise shown on the plans. Dispose of removed material in accordance with federal, state, and local regulations. Provide a smooth line and grade conforming to the adjacent pavement.

4.1. **Removing Pavement Structure**. Remove adjacent soil and vegetation if necessary to prevent contamination of the repair area, and place it in a windrow. Do not damage adjacent pavement structure during repair operations. Remove flexible pavement structure layers from work area if subgrade work is required.

4.2. **Preparing Subgrade**. Fill holes, ruts, and depressions with approved material. Wet, reshape, and compact the subgrade thoroughly as directed.

Remove unstable subgrade material to the depth directed and replace with an approved material where subgrade has failed.

4.3. **Mixing and Placing Base Material**. Place, spread, and compact material in accordance with the applicable Item to the required or directed depth. Pulverize bituminous material to a maximum dimension of 2-1/2 in. and uniformly mix with existing base to the depth shown on the plans when the material is to remain in pavement structure.

4.3.1. **Flexible Base**. Use existing base and add new flexible base as required in accordance with Item 247, "Flexible Base," and details shown on the plans to achieve required section.

4.3.2. **Lime-Stabilized Base**. Use existing base, add new flexible base, and stabilize with a minimum lime content of 3% by weight of the total mixture. Construct in accordance with Item 260, "Lime Treatment (Road-Mixed)," or Item 263, "Lime Treatment (Plant-Mixed)," and details shown on the plans to achieve required section.

4.3.3. **Cement-Stabilized Base**. Use existing base, add flexible base, and stabilize with a minimum cement content of 4% by weight of the total mixture. Construct in accordance with Item 275, "Cement Treatment (Road-Mixed)," or Item 276, "Cement Treatment (Plant-Mixed)," and details shown on the plans to achieve required section.

4.3.4. **Asphalt-Stabilized Base**. Place asphalt-stabilized base in accordance with Item 292, "Asphalt Treatment (Plant-Mixed),"or Item 340, "Dense-Graded Hot-Mix Asphalt (Small Quantity)," and details shown on the plans to achieve required section.

4.3.5. **Limestone Rock Asphalt**. Place in accordance with Item 330, "Limestone Rock Asphalt Pavement," and details shown on the plans to achieve required section.

4.4. **Curing Base**. Cure in accordance with the appropriate Item unless otherwise directed or approved. Maintain completed base sections until surfacing.

4.5. **Surfacing**. Apply surfacing with materials as shown on the plans to the completed base section.

4.5.1. **Prime Coat**. Protect the compacted, finished, and cured flexible, lime-stabilized, or cement-stabilized base mixtures with a prime coat of the type and grade shown on the plans. Apply the prime coat at the rate shown on the plans.

4.5.2. **Surface Treatments**. Apply surface treatment with the type and grade of asphalt and aggregate as shown on the plans in accordance with Item 316, "Seal Coat."

4.5.3. **Asphalt Concrete Pavement**. Apply tack coat of the type and grade and at the rate shown on the plans unless otherwise directed. Construct in accordance with Item 330, "Limestone Rock Asphalt Pavement," Item 334, "Hot-Mix Cold-Laid Asphalt Concrete Pavement," or Item 340, "Dense-Graded Hot-Mix Asphalt (Small Quantity)," to achieve required section.

4.6. **Finishing**. Regrade and compact disturbed topsoil. Clean roadway surface after repair operations.

5. MEASUREMENT

This Item will be measured by the square yard. In areas where material is excavated, as directed, to depths greater than those specified on the plans, measurement will be made by dividing the actual depth of such area by the plan depth and then multiplying this figure by the area in square yard of work performed. Calculations for each repaired area will be rounded up to the nearest 1/10 sq. yd. At each repair location, the minimum area for payment purposes will be 1 sq. yd.

The minimum quantity for Contracts with callout work is 5 sq. yd. per callout unless otherwise shown on the plans.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Flexible Pavement Structure Repair" of the specified depth. This price is full compensation for scarifying, removing, hauling, spreading, disposing of, and stockpiling existing pavement structure; removing objectionable or unstable material; furnishing and placing materials; maintaining completed section before surfacing; applying tack or prime coat; hauling, sprinkling, spreading, and compacting; and equipment, labor, tools, and incidentals.

Item 360
Concrete Pavement

1. DESCRIPTION

Construct hydraulic cement concrete pavement with or without curbs on the concrete pavement.

2. MATERIALS

Use materials from non-listed sources only when tested and approved by the Engineer before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

2.1. **Hydraulic Cement Concrete**. Provide hydraulic cement concrete in accordance with Item 421, "Hydraulic Cement Concrete." Use compressive strength testing unless otherwise shown on the plans. Provide Class P concrete designed to meet a minimum average compressive strength of 3,200 psi at 7 days or a minimum average compressive strength of 4,000 psi at 28 days. Test in accordance with Tex-418-A.

Obtain written approval if the concrete mix design exceeds 520 lb. per cubic yard of cementitious material.

Use coarse aggregates for continuously reinforced concrete pavements to produce concrete with a rated coefficient of thermal expansion not more than 5.5×10^{-6} in./in./°F as listed in accordance with the *Concrete Rated Source Quality Catalog*.

Provide Class High Early Strength (HES) concrete designed to meet a minimum average compressive strength of 3,200 psi at 24 hr., for early opening of small pavement areas or leave-outs to traffic when shown on the plans or allowed. When opening of small pavement areas or leave-outs to traffic is less than 24 hr., design Class HES concrete to achieve a minimum average compressive strength of 1,800 psi at 8 hr.

2.2. **Reinforcing Steel**. Provide Grade 60 or above deformed steel for bar reinforcement in accordance with Item 440, "Reinforcement for Concrete." Provide positioning and supporting devices (baskets and chairs) capable of securing and holding the reinforcing steel in proper position before and during paving. Provide corrosion protection when shown on the plans.

2.2.1. **Dowels**. Provide dowel bars for concrete pavements in accordance with DMS-7325, "Dowel Bars for Concrete Pavements" and the MPL for "Dowel Bars for Concrete Pavements." Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of the expansion joint.

2.2.2. **Tie Bars**. Provide straight deformed steel tie bars. Provide either multiple-piece tie bars or single-piece tie bars as shown on the plans. Furnish multiple piece tie bar assemblies from the list of approved multiple-piece tie bars that have been prequalified in accordance with DMS-4515, "Multiple Piece Tie Bars for Concrete Pavement," when used. Multiple-piece tie bars used on individual projects must be sampled in accordance with Tex-711-I, and tested in accordance with Tex-712-I.

2.3. **Curing Materials**. Provide Type 2 membrane curing compound in accordance with DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants." Provide asphaltic curing materials in accordance with Item 300, "Asphalts, Oils, and Emulsions," for concrete pavement to be overlaid with asphalt concrete, unless otherwise shown on the plans or approved. Provide materials for other methods of curing in accordance with Item 422, "Concrete Superstructures." When required, provide insulating blankets with a minimum thermal resistance (R) rating of 0.5 degree Fahrenheit square-foot per British Thermal Unit. Use insulating blankets that are free of tears and are in good condition.

2.4. **Epoxy**. Provide Type III, Class C epoxy in accordance with DMS-6100, "Epoxies and Adhesives," for installing all drilled-in reinforcing steel. Submit a work plan and request approval for the use of epoxy types other than Type III, Class C.

2.5. **Evaporation Retardant**. Provide evaporation retardant in accordance with DMS-4650.

2.6. **Joint Sealants and Fillers**. Provide Class 5 or Class 8 joint sealant materials and fillers unless otherwise shown on the plans or approved, and other sealant materials of the size, shape, and type shown on the plans in accordance with DMS-6310, "Joint Sealants and Fillers."

2.7. **Repair Materials**. Provide concrete repair materials in accordance with DMS-4655, "Concrete Repair Materials," or DMS-6170, "Polymeric Materials for Patching Spalls in Concrete Pavement."

3. EQUIPMENT

Furnish and maintain all equipment in good working condition. Use measuring, mixing, and delivery equipment in accordance with Item 421. Obtain approval for other equipment used.

3.1. **Placing, Consolidating, and Finishing Equipment**. Provide self-propelled paving equipment that uniformly distributes the concrete with minimal segregation and provides a smooth machine-finished consolidated concrete pavement conforming to plan line and grade. Provide an automatic grade control system on slip-forming equipment. Provide mechanically operated finishing floats capable of producing a uniformly smooth pavement surface. Provide equipment capable of providing a fine, light water fog mist.

When using stringless paving equipment, use in accordance with Section 5.9.3., "Method C," and establish control points at maximum intervals of 500 ft. Use these control points as reference to perform the work.

Provide mechanically operated vibratory equipment capable of adequately consolidating the concrete. Provide immersion vibrators on the paving equipment at sufficiently close intervals to provide uniform vibration and consolidation of the concrete over the entire width and depth of the pavement and in conformance with the manufacturer's recommendations. Provide immersion vibrator units that operate at a frequency in air of at least 8,000 cycles per minute. Provide enough hand-operated immersion vibrators for timely and proper consolidation of the concrete for concrete pavement (formed) placements, and along forms, at all joints, and in areas not covered by other vibratory equipment. Surface vibrators may be used to supplement equipment-mounted immersion vibrators. Provide tachometers to verify the proper operation of all vibrators.

For small or irregular areas or when approved, the paving equipment described in this Section is not required.

3.2. **Forming Equipment**.

3.2.1. **Pavement Forms**. Provide side forms of sufficient cross-section, strength, and rigidity to support the paving equipment and resist the impact and vibration of the operation without visible springing or settlement. Use forms that are free of detrimental kinks, bends, or warps that could affect ride quality or alignment. Provide bulkhead forms of sufficient cross-section, strength, and rigidity to support reinforcing steel and maintain alignment during concrete placement operations.

3.3. **Curb Forms**. Provide curb forms for separately placed curbs that are not slipformed that conform to the requirements of Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."

3.4. **Single-Piece Tie-Bar Inserting Equipment**. Provide inserting equipment that accurately inserts and positions reinforcing steel in the plastic concrete parallel to the profile grade and horizontal alignment as shown on the plans.

3.5. **Texturing Equipment**.

3.5.1. **Carpet Drag**. Provide a carpet drag mounted on a work bridge or a manual moveable support system. Provide a single piece of carpet of sufficient transverse length to span the full width of the pavement being placed and adjustable so that a sufficient longitudinal length of carpet is in contact with the concrete being placed to produce the desired texture. Obtain approval to vary the length and width of the carpet to accommodate specific applications.

3.5.2. **Tining Equipment**. Provide a self-propelled metal tine device equipped with steel tines with cross-section approximately 1/32 in. thick by 1/12 in. wide. Provide tines for longitudinal tining equipment spaced at approximately 3/4 in., center-to-center, or provide tines for transverse tining equipment spaced at approximately 1 in., center-to-center. Manual methods that produce an equivalent texture may be used when it is impractical to use self-propelled equipment, such as for small areas, narrow width sections, and emergencies due to equipment breakdown.

3.6. **Curing Equipment**. Provide a self-propelled machine for applying membrane curing compound using mechanically pressurized spraying equipment with atomizing nozzles. Provide equipment and controls that maintain the required uniform rate of application over the entire paving area. Hand-operated pressurized spraying equipment with atomizing nozzles may only be used on small or irregular areas, on narrow width sections, or in emergencies due to equipment breakdown.

3.7. **Sawing Equipment**. Provide power-driven concrete saws to saw the joints shown on the plans. Provide standby power-driven concrete saws during concrete sawing operations.

3.8. **Grinding Equipment**. Provide self-propelled powered grinding equipment that is specifically designed to smooth and texture concrete pavement using circular diamond blades when required. Provide equipment with automatic grade control capable of grinding at least a 3-ft. width longitudinally in each pass without damaging the concrete.

3.9. **Testing Equipment**. Provide testing equipment in accordance with Item 421, unless otherwise shown on the plans or specified. Maintain and calibrate all Contractor-supplied testing equipment in conformance with pertinent test methods. Provide calibration records of strength-testing equipment to the Engineer within 1 week after each calibration.

3.10. **Coring Equipment**. Provide coring equipment capable of extracting cores in accordance with Tex-424-A when required.

3.11. **Miscellaneous Equipment**. Furnish 10-ft. and 15-ft. steel or magnesium long-handled, standard straightedges. Furnish enough work bridges, long enough to span the pavement, for finishing and inspection operations.

4. CONSTRUCTION

Obtain approval for adjustments to plan grade-line to maintain thickness over minor subgrade or base high spots while maintaining clearances and drainage. Maintain subgrade or base in a smooth, clean, compacted condition in conformance with the required section and established grade until the pavement concrete is placed. Dampen subgrade or base with water before placing pavement concrete.

Adequately light the active work areas for all nighttime operations. Provide and maintain tools and materials to perform testing.

4.1. **Paving and Quality Control (QC) Plan**. Submit a paving and QC plan for approval before beginning pavement construction operations. Include details of all operations in the concrete paving process, including methods to construct transverse joints, methods to consolidate concrete at joints, longitudinal construction joint layout, sequencing, curing, lighting, early opening, leave-outs, sawing, inspection, contractor QC testing, testing for opening to traffic, construction methods, other details, and description of all equipment. List

certified personnel performing contractor QC testing and testing for opening to traffic. Submit revisions to the paving and QC plan for approval.

4.2. **Placing Reinforcing Steel for Continuously Reinforced Concrete Pavements**. Accurately place and secure in position all reinforcing steel as shown on the plans. Provide chairs in sufficient number to adequately support the reinforcing steel at the proper height as show on the plans. Secure reinforcing steel at alternate intersections with tie wires. Reinforcing steel intersections may be secured with locking support chairs instead of tie wires. Anchor pins used to prevent the reinforcing steel from shifting may remain in the final pavement. Stagger the lap locations so that no more than 1/3 of the longitudinal steel is spliced in any given 12-ft. width and 2-ft. length of the pavement. Tie all splices with tie wires.

4.3. **Joints**. Install formed joints as shown on the plans. Install transverse bulkhead forms to support extending reinforcing steel, shaped accurately to the cross-section of the pavement when placing of concrete is stopped.

4.3.1. **Placing Reinforcement at Joints**. Install reinforcing steel at transverse construction joints as shown on the plans. Use multiple-piece tie bars, drilled and epoxy-grouted tie bars, or mechanically inserted single-piece tie bars at longitudinal construction joints. Discontinue the use of mechanically inserted single-piece tie bars if this method results in steel misalignment or improper location, poor concrete consolidation, or other inadequacies. Protect the reinforcing steel immediately beyond the construction joint from damage, vibration, and impact.

For drilled and epoxy-grouted tie bars, drill holes into the existing concrete at least 10 in. deep unless otherwise directed. Use a drill bit with a diameter that is 1/8 in. greater than that of tie bars. Clean the holes using a wire brush and compressed air to remove all the dust and moisture. Only cartridge or machine applicator epoxies are allowed. Follow the epoxy manufacturer's instructions to apply the epoxy. Insert the tip of the epoxy cartridge or the tip of the machine applicator to the end of the tie bar hole, and inject Type III, Class C, epoxy to fill the hole with the amount of epoxy recommended by the manufacture for the size of bar and depth of hole. Insert tie bars.

4.3.2. **Testing of Tie Bars**. Verify that tie bars that are drilled and epoxied or mechanically inserted into concrete at longitudinal construction joints develop a pullout resistance equal to at least 3/4 of the yield strength of the reinforcing steel. Test pullout resistance of mechanically inserted tie bars when the concrete pavement is at least 7 days old. Test pullout resistance of epoxy-grouted bars after the epoxy manufacturer's recommended final cure time. Test 15 bars in accordance with ASTM E488, except that alternate approved equipment may be used. All 15 tested bars must meet the required pullout strength. Perform corrective measures to provide equivalent pullout resistance if any of the test results do not meet the required minimum pullout strength. Repair damage from testing.

4.3.3. **Testing of Epoxy-Grouted Longitudinal Bars in Continuously Reinforced Concrete Pavements**. When longitudinal reinforcing steel is drilled and epoxy-grouted in existing pavement, test each bar in accordance with ASTM E488, except that alternate approved equipment may be used. All bars must develop a pullout resistance equal to at least 3/4 of the yield strength of the steel. Test pullout resistance after the epoxy manufacturer's recommended final cure time. Perform corrective measures to provide equivalent pullout resistance if any of the test results do not meet the required minimum pullout strength. Repair damage from testing.

4.3.4. **Transverse Construction Joints for Concrete Pavement Contraction Design (CPCD)**. Install and rigidly secure a complete joint assembly and bulkhead in the planned transverse contraction joint location when the placing of concrete is intentionally stopped. Install a transverse construction joint either at a planned transverse contraction joint location or mid-slab between planned transverse contraction joints when the placing of concrete is unintentionally stopped. Install tie bars of the size and spacing used in the longitudinal joints for mid-slab construction joints.

Place dowels at mid-depth of the pavement slab, parallel to the surface. Place dowels for transverse contraction joints parallel to the pavement edge. Tolerances for location and alignment of dowels will be shown on the plans. For dowels used in a contraction joint, coat the entire length of the dowels with a thin

film of grease, wax, silicone, or other approved de-bonding material. For dowels used in an expansion joint, coat half the length with a thin film of grease, wax, silicone, or other approved de-bonding material; provide dowel caps on the coated half of each dowel bar.

4.4. **Curb Joints**. Construct curb joints in accordance with Item 529.

4.5. **Placing and Removing Forms**. Use clean and oiled forms. Secure forms on a base or firm subgrade that is accurately graded and that provides stable support without deflection and movement by formriding equipment. Pin every form at least at the middle and near each end. Tightly join and key form sections together to prevent relative displacement.

Set side forms far enough in advance of concrete placement to permit inspection. Check conformity of the grade, alignment, and stability of forms immediately before placing concrete, and make all necessary corrections. Use a straightedge or other approved method to test the top of forms to ensure that the ride quality requirements for the completed pavement will be met. Stop paving operations if forms settle or deflect more than 1/8 in. under finishing operations. Reset forms to line and grade, and refinish the concrete surface to correct grade.

Avoid damage to the edge of the pavement when removing side forms and bulkhead forms. Repair damage resulting from form removal with an approved repair material within 24 hr. after form removal unless otherwise approved. Chip excessively honeycombed areas to sound concrete, and repair with an approved repair material within 24 hr. after form removal unless otherwise approved. Clean joint face within 24 hr. after a bulkhead for a transverse construction joint has been removed unless otherwise approved. Promptly apply membrane curing compound to the edge of the concrete pavement when forms are removed before 72 hr. after concrete placement.

Forms that are not the same depth as the pavement but within 2 in. of that depth are permitted if the subbase is trenched or the full width and length of the form base are supported with a firm material to produce the required pavement thickness. Promptly repair the form trench after use. Use flexible or curved wood or metal forms for curves of 100-ft. radius or less.

4.6. **Concrete Delivery**. Clean delivery equipment as necessary to prevent accumulation of old concrete before loading fresh concrete. Use agitated delivery equipment for concrete designed to have a slump of more than 5 in. Segregated concrete is subject to rejection.

Begin the discharge of concrete delivered in agitated delivery equipment in accordance with Item 421. Place non-agitated concrete within 45 min. after batching. Reduce times as directed when hot weather or other conditions cause quick setting of the concrete.

4.7. **Concrete Placement**. Do not allow the pavement edge to deviate from the established paving line by more than 1/2 in. at any point. Place the concrete as near as possible to its final location, and minimize segregation and rehandling. Distribute concrete using shovels where hand spreading is necessary. Do not use rakes or vibrators to distribute concrete.

4.7.1. **Consolidation**. Consolidate all concrete using approved mechanical vibrators operated on the front of the paving equipment. Use immersion-type vibrators that simultaneously consolidate the full width of the placement when machine finishing. Keep vibrators from dislodging reinforcement. Use hand-operated vibrators to consolidate concrete for concrete pavement (formed) placements, and along forms, at all joints, and in areas not accessible to the machine-mounted vibrators. Do not operate machine-mounted vibrators while the paving equipment is stationary. Vibrator operations are subject to review.

4.7.2. **Curbs**. Curbs will be in accordance with Item 529.

4.7.3. **Temperature Restrictions**. Place concrete that is between 40°F and 95°F when measured in accordance with Tex-422-A at the time of discharge, except that concrete may be used if it was already in transit when the temperature was found to exceed the allowable maximum. Take immediate corrective action or cease concrete production when the concrete temperature exceeds 95°F.

Do not place concrete when the ambient temperature in the shade is below 40°F and falling, unless approved. Concrete may be placed when the ambient temperature in the shade is above 35°F and rising or above 40°F. Protect the pavement with an approved insulating material capable of protecting the concrete for the specified curing period when temperatures warrant protection against freezing. Submit for approval proposed measures to protect the concrete from anticipated freezing weather for the first 72 hr. after placement. Repair or replace all concrete damaged by freezing.

4.8. **Spreading and Finishing**. Finish all concrete pavement using approved self-propelled equipment. Use power-driven spreaders, power-driven vibrators, power-driven strike-off screed, or approved alternate equipment to strike-off the surface of the concrete to the required section and grade without surface voids. Use float equipment for final finishing. Use concrete with a consistency that allows completion of all finishing operations without addition of water to the surface. Use the minimal amount of water fog mist necessary to maintain a moist surface. Reduce fogging if float or straightedge operations result in excess slurry.

4.8.1. **Finished Surface**. Perform sufficient checks using a minimum 10-ft. long straightedge on the plastic concrete to ensure the final surface is within the tolerances specified in Surface Test A in accordance with Item 585, “Ride Quality for Pavement Surfaces.” Check with the straightedge parallel to the centerline.

4.8.2. **Maintenance of Surface Moisture**. Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens, or the use of evaporation retardants. Apply evaporation retardant at the manufacturer’s recommended rate. Reapply the evaporation retardant as needed to maintain the concrete surface in a moist condition until curing system is applied. Do not use evaporation retardant as a finishing aid. Failure to take acceptable precautions to prevent surface drying of the pavement will be cause for shutdown of pavement operations.

4.8.3. **Surface Texturing**. Complete final texturing before the concrete has attained its initial set. Drag the carpet longitudinally along the pavement surface with the carpet contact surface area adjusted to provide a satisfactory coarsely textured surface. Prevent grout from plugging the carpet. Do not perform carpet dragging operations while there is excessive bleed water.

A metal-tine texture finish is required unless otherwise shown on the plans. Provide longitudinal tining unless otherwise shown on the plans. Immediately following the carpet drag, apply a single coat of evaporation retardant, if needed, at the rate recommended by the manufacturer. Provide the metal-tine finish immediately after the concrete surface has set enough for consistent tining. Operate the metal-tine device to obtain grooves approximately 3/16 in. deep, with a minimum depth of 1/8 in., and approximately 1/12 in. wide. Do not overlap a previously tined area. Use manual methods to achieve similar results on ramps, small or irregular areas, and narrow width sections of pavements. Repair damage to the edge of the slab and joints immediately after texturing. Do not tine pavement that will be overlaid or that is scheduled for blanket diamond grinding or shot blasting.

Target a carpet drag texture of 0.04 in., as measured by Tex-436-A, when carpet drag is the only surface texture required on the plans. Ensure adequate and consistent macro-texture is achieved by applying enough weight to the carpet and by keeping grout from plugging the carpet. Correct any location with a texture less than 0.03 in. by diamond grinding or shot blasting. The Engineer will determine the test locations at points located transversely to the direction of traffic in the outside wheel path.

4.8.4. **Small, Irregular Area, or Narrow Width Placements**. Use hand equipment and procedures that produce a consolidated and finished pavement section to the line and grade where machine placements and finishing of concrete pavement are not practical.

4.8.5. **Emergency Procedures**. Use hand-operated equipment for applying texture, evaporation retardant, and cure in the event of equipment breakdown.

4.9. **Curing**. Keep the concrete pavement surface from drying in accordance with Section 360.4.8.2., “Maintenance of Surface Moisture,” until the curing material has been applied. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days. A curing day is defined as a 24-hr. period when either the temperature taken in the shade away from

artificial heat is above 50°F for at least 19 hr. or the surface temperature of the concrete is maintained above 40°F for 24 hr. Curing begins when the concrete curing system has been applied. Stop concrete paving if curing compound is not being applied promptly and maintained adequately. Other methods of curing in accordance with Item 422 may be used when specified or approved.

4.9.1. **Membrane Curing**. Spray the concrete surface uniformly with two coats of membrane curing compound at an individual application rate of no more than 180 sq. ft. per gallon. Apply the curing compound before allowing the concrete surface to dry.

Manage finishing and texturing operations to ensure placement of curing compound on a moist concrete surface, relatively free of bleed water, to prevent any plastic shrinkage from cracking. Time the application of curing compound to prevent plastic shrinkage from cracking.

Maintain curing compounds in a uniformly agitated condition, free of settlement before and during application. Do not thin or dilute the curing compound.

Apply additional compound at the same rate of coverage to correct damage where the coating shows discontinuities or other defects or if rain falls on the newly coated surface before the film has dried enough to resist damage. Ensure that the curing compound coats the sides of the tining grooves.

4.9.2. **Asphalt Curing**. Apply a uniform coating of asphalt curing at a rate of 90 sq. ft.–180 sq. ft. per gallon when an asphaltic concrete overlay is required. Apply curing immediately after texturing and once the free moisture (sheen) has disappeared. Obtain approval to add water to the emulsion to improve spray distribution. Maintain the asphalt application rate when using diluted emulsions. Maintain asphalt emulsions in a mixed condition during application.

4.9.3. **Curing Class HES Concrete**. Provide membrane curing in accordance with Section 360.4.9.1., “Membrane Curing,” or wet mat curing in accordance with Section 422.4.8., “Final Curing,” for all Class HES concrete.

4.10. **Sawing Joints**. Saw joints to the depth shown on the plans as soon as sawing can be accomplished without damage to the pavement, regardless of time of day or weather conditions. Some minor raveling of the saw-cut is acceptable. Use a chalk line, string line, sawing template, or other approved method to provide a true joint alignment. Provide enough saws to match the paving production rate to ensure sawing completion at the earliest possible time to avoid uncontrolled cracking. The Engineer will evaluate the cause of the uncontrolled cracking and direct any necessary repairs. Reduce paving production if necessary to ensure timely sawing of joints. Promptly restore membrane cure damaged within the first 72 hr. of curing.

The Engineer will check the depth of saw cuts in accordance with Tex-423-A within 24 hrs. after saw-cutting or before joints are sealed, whichever is sooner. Frequency of checks will be as follows:

- every 500 ft. or fraction thereof for all longitudinal contraction joints, and
- 10% of transverse contraction joints in CPCD for each daily placement.

Resaw contraction joints that are deficient in depth by more than 1/4 in. from plan depth within 24 hr. of depth checks.

4.11. **Cleaning and Sealing Joints**. Clean and seal joints in accordance with Item 438, “Cleaning and Sealing Joints.” Repair excessive spalling of the joint saw groove using an approved method before installing the sealant. Seal all joints before opening the pavement to all traffic. Joint sealants are not required on concrete pavement that is to be overlaid with asphaltic materials.

4.12. **Protection of Pavement**. Erect and maintain barricades and other standard and approved devices that will exclude all vehicles and equipment from the newly placed pavement for the periods specified. Protect the pavement from damage due to crossings using approved methods before opening to traffic. Where a detour is not readily available or economically feasible, an occasional crossing of the roadway with overweight equipment may be permitted for relocating equipment only, but not for hauling material. When an occasional

crossing of overweight equipment is permitted, temporary matting or other approved methods may be required.

Maintain an adequate supply of sheeting or other material to cover and protect fresh concrete surface from weather damage. Apply as needed to protect the pavement surface from weather.

4.13. **Opening to Traffic**. Testing for opening pavement to traffic is the responsibility of the Contractor unless otherwise shown on the plans or as directed. Before opening pavement to traffic:

- provide test results to the Engineer for review, if necessary,
- clean pavement,
- place stable material against pavement edges,
- seal joints, and
- perform all other traffic-safety related work.

4.13.1. **Opening Pavement to All Traffic**. Pavements can be open to all traffic:

- when the pavement is 7 days old,
- when 3-day curing is complete and the concrete has attained a compressive strength of 3,200 psi,
- after 24 hr. and the concrete has attained a compressive strength of 3,200 psi when Class HES concrete is used, or
- after the concrete has been cured for at least 8 hr. and attained a minimum compressive strength of 1,800 psi when Class HES concrete is used.

4.13.2. **Opening Pavement to Construction Equipment**. Unless otherwise shown on the plans, concrete pavement may be opened to concrete paving equipment and related delivery equipment after the concrete is at least 48 hr. old and has attained a compressive strength of 3,200 psi. Keep delivery equipment at least 2 ft. from the edge of the concrete pavement. Keep tracks of the paving equipment at least 1 ft. from the pavement edge. Protect textured surfaces from the paving equipment. Restore damaged membrane curing as soon as possible. Repair pavement damaged by paving or delivery equipment before opening to all traffic.

4.13.3. **Maturity Method**. Maturity method, in accordance with Tex-426-A, may be used to estimate concrete strength for opening pavement to traffic. Install at least two maturity sensors for each day's placement in areas where the maturity method will be used for opening. Maturity sensors, when used, will be installed near the day's final placement for areas being evaluated.

The Engineer will test specimens to verify the strength-maturity relationship in accordance with Tex-426-A. The strength-maturity relationship will be verified at least every 10 days of production after the first day. Establish a new strength-maturity relationship when the strength specimens deviate more than 10% from the maturity-estimated strengths. Suspend use of the maturity method for opening pavements to traffic when the strength-maturity relationship deviates by more than 10% until a new strength-maturity relationship is established.

The Engineer will determine the frequency of verification when the maturity method is used intermittently or for only specific areas.

4.13.4. **Emergency Opening to Traffic**. Open the pavement to traffic under emergency conditions, when the pavement is at least 72 hr. old, when directed in writing.

4.14. **Sampling and Testing of Concrete**. Unless otherwise specified, all fresh and hardened concrete is subject to testing as follows.

4.14.1. **Fresh Concrete**. Provide safe access and assistance to the Engineer during sampling. Fresh concrete will be sampled in accordance with Tex-407-A.

4.14.2. **Testing Concrete**. The Engineer will test the fresh and hardened concrete in accordance with the following methods:

- **Slump**. Tex-415-A, only for formed concrete pavement placements;
- **Air Content**. Tex-414-A or Tex-416-A, only when air-entrained concrete is shown on the plans;
- **Temperature**. Tex-422-A;
- **Making and Curing Strength Specimens**. Tex-447-A;
- **Compressive Strength**. Tex-418-A; and
- **Maturity**. Tex-426-A.

Maturity specimens will be made only when maturity method is used or shown on the plans.

Concrete with slump less than minimum required after all addition of water withheld will be rejected, unless otherwise allowed by the Engineer. Concrete with slump exceeding maximum allowed may be used at the Contractor's option. If used, Engineer will make, test, and evaluate strength specimens in accordance with Section 360.4.15., "Acceptance of Concrete Pavement." Acceptance of concrete not meeting air content or temperature requirements will be determined by Engineer. Fresh concrete exhibiting segregation and excessive bleeding will be rejected.

4.14.2.1. **Strength Specimen Handling**. After strength test specimens are molded, protect and cure in conformance with pertinent test methods. When necessary, deliver Contractor-molded specimens to curing facilities, remove specimens from their molds, and place specimens in curing tanks within 24–48 hr. after molding, in conformance with pertinent test methods. The Engineer will deliver Department-molded specimens to curing facilities, remove specimens from their molds, and place specimens in curing tanks within 24–48 hr. after molding, in conformance with pertinent test methods.

4.15. **Acceptance of Concrete Pavement**. The Engineer will determine pay adjustments for deficient pavement thickness within 14 days after concrete pavement has been cored. The Engineer will determine structural adequacy of low concrete strengths within 7 days after design strength specimens or cores, if taken, are tested.

4.15.1. **Pavement Thickness**. The Engineer will check the thickness in accordance with Tex-423-A unless other methods are shown on the plans. The Engineer will perform one thickness test consisting of one reading at approximately the center of the paving equipment every 500 ft. or fraction thereof. Core where directed, in accordance with Tex-424-A, to verify deficiencies. Do not core until pavement is at least 7 days old or has achieved design strength. Fill core holes using an approved concrete mixture and method.

4.15.1.1. **Assessing Payment Adjustments**. Limits for applying a payment adjustment for deficient pavement thickness are 500 ft. units of pavement in each lane. Lane width will be as shown on typical sections and in conformance with pavement design standards.

The limits for retaining deficient pavement without compensation or removing and replacing without additional compensation will be defined by coring or equivalent nondestructive means as determined by the Engineer. The remaining portion of the 500-ft. unit allowed for pay adjustment will be subject to the payment adjustment based on the average core thickness deficiency at each end of the 10-ft. interval investigation as determined by the Engineer.

Shoulders will be measured for thickness unless otherwise shown on the plans. Shoulders 6 ft. wide or wider will be considered as lanes. Shoulders less than 6 ft. wide will be considered part of the adjacent lane. Shoulders less than 6 ft. wide and placed separately from the adjacent lane will be considered as a lane.

Limits for applying payment adjustment for deficient pavement thickness for ramps, widenings, acceleration and deceleration lanes, and other miscellaneous areas are 500-ft. units. Areas less than 500-ft. units will be individually evaluated for payment adjustment based on the plan area.

4.15.1.2. **Verification of Thickness Deficiencies**. When any fresh depth test measured in accordance with Tex-423-A is deficient by more than 0.50 in. from the plan thickness, take one 4-in. diameter core at that location to verify the measurement.

When determining the average thickness deficiency for assessing a pay adjustment other than retaining pavement without compensation or remove and replace as shown in Table 1, take at least two additional cores from the unit, in accordance with Section 360.4.15.1.1., "Assessing Payment Adjustments," equidistantly spaced from the first core in each direction if the first core is deficient by more than 0.50 in. from the plan thickness. Measure the length of cores in accordance with Tex-424-A. Determine the average thickness by averaging the lengths of the cores. Subtract the calculated average thickness from the plan thickness to determine the average thickness deficiency. In calculations of the average thickness, measurements exceeding the plan thickness by more than 0.2 in. will be considered as the plan thickness plus 0.2 in.

When determining the limits for retaining the deficient pavement without compensation or remove and replace without additional compensation, take additional cores at 10-ft. intervals in each direction parallel to the centerline to determine the boundary of the deficient area if the first core length deficiency is more than 1.00 in. for pavements less than 11 in. thick or more than 1.50 in. for pavements 11 in. or thicker. Continue taking cores at 10-ft. intervals until the core length deficiency is less than 1.00 in. for pavements less than 11 in. thick or less than 1.50 in. for pavements 11 in. or thicker.

4.15.2. **Strength of Concrete Pavement**. The Engineer will accept concrete pavement meeting a compressive strength of 3,200 psi at 7 days or meeting a compressive strength of 4,000 psi at 28 days for Class P concrete.

Concrete strength testing may be correlated to an age other than 7 days in accordance with Tex-427-A when approved.

The Engineer will accept concrete pavement using Class HES concrete based on the required strength and time.

Investigate the strength test procedures, the quality of materials, the concrete production operations, and other possible problem areas to determine the cause when a concrete strength test value is more than 10% below the required strength or when three consecutive strength values fall below the required strength. Take necessary action to correct the problem, including redesign of the concrete mix if needed. The Engineer may suspend concrete paving if the Contractor is unable to identify, document, and correct the cause of low-strength test values in a timely manner. The Engineer will evaluate the structural adequacy of the pavements if any strength is more than 15% below the required strength. Remove and replace pavements found to be structurally inadequate at no additional cost when directed.

4.15.3. **Ride Quality**. Measure and correct ride quality in accordance with Item 585, unless otherwise shown on the plans.

5. MEASUREMENT

This Item will be measured as follows.

5.1. **Concrete Pavement**. Concrete pavement will be measured by the square yard of surface area in place. The surface area includes the portion of the pavement slab extending beneath the curb.

6. PAYMENT

These prices are full compensation for materials, equipment, labor, tools, and incidentals.

6.1. **Concrete Pavement**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Pavement" of

the type and depth specified as adjusted in accordance with Section 360.6.2., "Deficient Thickness Adjustment."

6.2. **Deficient Thickness Adjustment**. Where the average thickness of pavement is deficient in thickness, payment will be made using the adjustment factor in accordance with Table 1 applied to the bid price for the deficient area for each unit in accordance with Section 360.4.15.1.1., "Assessing Payment Adjustments." When pavement thickness investigation (coring) is conducted for three consecutive placements, remove and replace without additional compensation all pavement placed during these days if the average thickness deficiency from all cores taken from these consecutive placements is greater than 0.25 in.

Table 1
Deficient Thickness Price Adjustment Factor

Deficiency in Thickness Determined by Cores (in.)	**Proportional Part of Contract Price Allowed (Adjustment Factor) for Thickness <11 inches**
Not deficient	1.00
Over 0.00 through 0.50	1.00
Over 0.50 through 0.75	0.80
Over 0.75 through 1.00	0.60
Over 1.00 through 1.25	Retain pavement without compensation or Remove and Replace
Over 1.25	Remove and Replace
Deficiency in Thickness Determined by Cores (in.)	**Proportional Part of Contract Price Allowed (Adjustment Factor) for Thickness ≥11 inches**
Not deficient	1.00
Over 0.00 through 0.50	1.00
Over 0.50 through 0.75	0.90
Over 0.75 through 1.00	0.80
Over 1.00 through 1.50	0.60
Over 1.50 through 2.00	Retain pavement without compensation or Remove and replace
Over 2.00	Remove and replace

6.3. **Curb**. All curbs will be paid for under Item 529.

Item 361
Full-Depth Repair of Concrete Pavement

1. DESCRIPTION

Repair concrete pavement to full depth in accordance with the details shown on the plans and the requirements of this Item.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 360, "Concrete Pavement"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"
- DMS-6100, "Epoxies and Adhesives"
- DMS-4655, "Concrete Repair Materials"

2.1. **Full-Depth Repair**. Obtain approval for the repair material mix design. The selection of repair material should be based on the time for opening to traffic and temperature range during the repair.

2.1.1. **Hydraulic Cement Concrete for Pavement**. Provide Class High Early Strength (HES) concrete designed to attain a minimum average flexural strength of 255 psi or a minimum average compressive strength of 1,800 psi within the designated timeframe if the timeframe designated for opening to traffic is less than 72 hr. after concrete placement. Otherwise, provide Class P concrete in accordance with Item 360.

Provide material in accordance with DMS-4655 Type A when Class HES concrete does not meet the strength requirement within the designated timeframe.

2.1.2. **Asphalt Concrete**. Furnish asphalt concrete material for overlay and asphalt shoulder repair as shown on the plans or when directed. The Engineer may waive quality control tests for this material.

3. EQUIPMENT

Provide tools and equipment necessary for proper execution of the work that meet the pertinent requirements of the following.

- Item 360
- **Concrete Demolition Equipment**. Provide hammers or hydro-demolition equipment for the bulk removal of concrete.
- **Concrete Lift-Out Equipment**. Provide steel chains, lift pins, and a crane or front-end loader capable of lifting the concrete and loading it onto a flatbed or dump truck.
- **Drill**. Use a drill with tungsten carbide bits.
- **Air Compressor**. Provide compressor equipped with filters designed to remove oil from the air and capable of delivering air to remove dust and debris.

4. CONSTRUCTION

Submit for approval all materials and methods of application at least 2 weeks before beginning any repair work. Repair locations will be as indicated on the plans or as directed. Repair areas may be adjusted after

removing distressed concrete. Compensation will be made for unexpected volumes of repair areas or changes in scope of work.

4.1. **Full-Depth Repair**. Repair areas identified by the Engineer. Make repair areas rectangular, at least 6 ft. long, and at least 1/2 a full lane in width, unless otherwise shown on the plans. Accept ownership of all removed material, and dispose of it in accordance with federal, state, and local regulations unless otherwise shown on the plans. Saw-cut and remove existing asphalt concrete overlay at least 2 ft. longer than the repair patch in each longitudinal direction when there is existing asphalt concrete overlay over the repair area.

Saw-cut the full depth through the concrete around the perimeter of the repair area before removal. Schedule work so that concrete placement follows full-depth saw-cutting by no more than 7 days unless otherwise shown on the plans or approved.

Remove the slab by lifting the slab with a minimum disturbance to the base materials and surrounding concrete. Do not spall or fracture concrete adjacent to the repair area. Saw-cut and remove additional concrete as directed, after slab removal, if distresses are found in the surrounding concrete pavement. Repair damages to concrete pavement caused by the Contractor's operation without additional compensation. Perform repairs as directed.

Remove loose or damaged base material completely, leaving no loose base material. Recompact, if necessary, existing base materials to the Engineer's satisfaction.

Use tie bars to restore the continuity of the concrete pavement as shown on the plans. Demonstrate, by simulated job conditions, that the bond strength of the epoxy-grouted tie bars meets a pullout strength of at least 3/4 of the yield strength of the tie bar when tested in accordance with ASTM E488 within the epoxy manufacturer's recommended curing time. Perform corrective measures and retest when necessary to meet testing requirements. Perform tie bar testing before starting repair work. During the preconstruction meeting, discuss the estimate of the number of epoxy cartridges per repair size that will be used to fill the tie-bar holes.

Place tie bars as shown on the plans. Drill holes into the existing concrete at least 10 in. deep unless otherwise directed. Use a drill bit with a diameter that is 1/8 in. greater than that of tie bars. Clean the holes with a wire brush and compressed air to remove all the dust and moisture. Only cartridge or machine applicator epoxies will be allowed. Follow the epoxy manufacturer's instructions to apply the epoxy. Insert the tip of the epoxy cartridge or the tip of the machine applicator into the end of the tie bar hole, and inject Type III, Class C epoxy to fill the entire hole. Insert tie bars.

Place new deformed reinforcing steel bars of the same size and spacing as those shown on the plans for continuously reinforced concrete pavement (CRCP) repairs. Lap all longitudinal reinforcing steel at least 25 in. Provide and place supports to firmly hold the new reinforcing steel in place when needed.

Place dowel bars as shown on the plans for concrete pavement contraction design (CPCD) repairs. Provide and place supports to firmly hold the dowel bars in place.

After removing all loose base material and installing all necessary reinforcing steel, place concrete directly on the remaining existing base.

Mix, place, cure, and test concrete in accordance with Item 360 and Item 421. Broom-finish the concrete surface unless otherwise shown on the plans.

Perform a timely saw-cut over the dowel bars at transverse contraction joints for CPCD in accordance with Section 360.4.10., "Sawing Joints." Clean and seal CPCD transverse contraction joints and any existing longitudinal joints in accordance with Section 360.4.11., "Cleaning and Sealing Joints."

Match the grade and alignment of existing concrete pavement. Replace any asphalt overlay and shoulder material removed with new asphalt concrete material after concrete strength requirements have been met.

Remove repair area debris from the right of way each day. Concrete pavement may be opened to traffic when specified strength is achieved.

The maturity method, Tex-426-A, may be used to estimate concrete strength for opening pavement to traffic, in accordance with Section 360.4.13.3., "Maturity Method."

5. MEASUREMENT

This Item will be measured by the cubic yard of material in place of the completed concrete area repaired. Volume will be computed based on the measured area in place and the average depth measured in place.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as specified under "Measurement" will be paid for at the unit price bid for "Repair of Concrete Pavement (Full-Depth)." This price is full compensation for removal, stockpiling, and disposal of waste material and for equipment, materials, labor, tools, and incidentals. Asphalt concrete, pavement markings, and curbing will be paid for under pertinent Items.

Item 464
Reinforced Concrete Pipe

1. DESCRIPTION

Furnish and install reinforced concrete pipe, materials for precast concrete pipe culverts, or precast concrete storm drain mains, laterals, stubs, and inlet leads.

2. MATERIALS

2.1. **Fabrication**. Multi-project fabrication plants, as defined in DMS-7305, "Fabrication and Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Drainage Structures," must be approved by the Materials and Tests Division in accordance with DMS-7305 before furnishing precast reinforced concrete pipe for Department projects. The Department's MPL includes approved multi-project reinforced concrete pipe fabrication plants.

Furnish material and fabricate reinforced concrete pipe in accordance with DMS-7305.

2.2. **Design**.

2.2.1. **General**. The class and D-load equivalents are shown in Table 1. Furnish arch pipe in accordance with ASTM C506 and the dimensions shown in Table 2. Furnish horizontal elliptical pipe in accordance with ASTM C507 and the dimensions shown in Table 3. For arch pipe and horizontal elliptical pipe, the minimum height of cover required is 1 ft.

Table 1
Circular Pipe
ASTM C76 and ASTM C655

Class	D-Load
I	800
II	1,000
III	1,350
IV	2,000
V	3,000

Table 2
Arch Pipe

Design Size	Equivalent Diameter (in.)	Rise (in.)	Span (in.)
1	18	13-1/2	22
2	21	15-1/2	26
3	24	18	28-1/2
4	30	22-1/2	36-1/4
5	36	26-5/8	43-3/4
6	42	31-5/16	51-1/8
7	48	36	58-1/2
8	54	40	65
9	60	45	73
10	72	54	88

Table 3
Horizontal Elliptical Pipe

Design Size	Equivalent Diameter (in.)	Rise (in.)	Span (in.)
0	15	12	19
1	18	14	23
2	24	19	30
3	27	22	34
4	30	24	38
5	33	27	42
6	36	29	45
7	39	32	49
8	42	34	53
9	48	38	60
10	54	43	68

2.2.2. **Jacking, Boring, or Tunneling**. Design pipe for jacking, boring, or tunneling considering the specific installation conditions such as the soil conditions, installation methods, anticipated deflection angles, and jacking stresses. Provide design notes and drawings signed and sealed by a Texas licensed professional engineer when requested. Provide steel reinforcement in bell and spigot.

2.3. **Marking**. Furnish each section of reinforced concrete pipe marked with the following information in accordance with DMS-7305:

- class or D-load of pipe,
- ASTM designation,
- date of manufacture,
- pipe size,
- name or trademark of fabricator and plant location,
- designation “TX” for precast units fabricated in accordance with DMS-7305,
- designated fabricator’s approval stamp for each approved unit,
- pipe to be used for jacking and boring (when applicable), and
- designation “SR” for pipe meeting sulfate-resistant concrete plan requirements (when applicable).

Clearly mark one end of each section during the process of manufacture or immediately thereafter for pipe with elliptical reinforcement. Mark the pipe on the inside and outside of opposite walls to show the location of the top or bottom of the pipe as it should be installed unless the external shape of the pipe is such that the correct position of the top and bottom is obvious. Mark the pipe section by indenting or painting with waterproof paint.

2.4. **Inspection**. Provide access for inspection of the finished pipe at the project site before and during installation.

2.5. **Causes for Rejection**. Individual sections of pipe may be rejected for any of the conditions stated in the DMS-7305 Annex.

2.6. **Repairs**. Make repairs, if necessary, in accordance with the DMS-7305 Annex.

2.7. **Jointing Materials**. Use any of the following materials for the making of joints unless otherwise shown on the plans. Furnish a manufacturer’s certificate of compliance for all jointing materials except mortar.

2.7.1. **Mortar**. Provide mortar for joints that meets the requirements of Section 464.3.3., “Jointing.”

2.7.2. **Cold-Applied, Plastic Asphalt Sewer Joint Compound**. Provide a material that consists of natural or processed asphalt base, suitable volatile solvents, and inert filler. Ensure the consistency is such that the ends of the pipe can be coated with a layer of the compound up to 1/2 in. thick by trowel. Provide a joint

compound that cures to a firm, stiff plastic condition after application. Provide a material of a uniform mixture. Stir any small separation found in the container into a uniform mix before using.

Provide a material that meets the requirements shown in Table 4 when tested in accordance with Tex-526-C.

Table 4
Cold-Applied, Plastic Asphalt Sewer Joint Compound Material Requirements

Composition	Analysis
Asphalt base, 100%–% volatiles–% ash, % by weight	28–45
Volatiles, 212°F evaporation, 24 hr., % by weight	10–26
Mineral matter, determined as ash, % by weight	30–55
Consistency, cone penetration, 150 q, 5 sec., 77°F	150–275

2.7.3. **Rubber Gaskets**. Provide gaskets that conform to ASTM C1619 Class A or Class C. Meet the requirements of ASTM C443 for design of the pipe joints and permissible variations in dimensions.

2.7.4. **Pre-Formed Flexible Joint Sealants**. Pre-formed flexible joint sealants may be used for sealing joints of tongue-and-groove concrete pipe. Provide flexible joint sealants that meet the requirements of ASTM C990. Use flexible joint sealants that do not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. Supply in extruded rope form of suitable cross-section. Provide a size of the pre-formed flexible joint sealant in conformance with the manufacturer's recommendations and large enough to properly seal the joint. Protect flexible joint sealants with a suitable wrapper able to maintain the integrity of the jointing material when the wrapper is removed.

3. CONSTRUCTION

3.1. **Excavation, Shaping, Bedding, and Backfill**. Excavate, shape, bed, and backfill in accordance with Item 400, "Excavation and Backfill for Structures," except where jacking, boring, or tunneling methods are permitted. Jack, bore, or tunnel the pipe in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box." Immediate backfilling is permitted if joints consist of materials other than mortar. Take special precautions in placing and compacting the backfill to avoid any movement of the pipe or damage to the joints. Do not use heavy earth-moving equipment to haul over the structure until at least 4 ft. of permanent or temporary compacted fill has been placed over the structure, unless otherwise shown on the plans or permitted in writing. Remove and replace pipe damaged by the Contractor at no expense to the Department.

3.2. **Laying Pipe**. Start the laying of pipe on the bedding at the outlet end with the spigot or tongue end pointing downstream and proceed toward the inlet end with the abutting sections properly matched, true to the established lines and grades unless otherwise authorized. Fit, match, and lay the pipe to form a smooth, uniform conduit. Cut cross trenches in the foundation to allow the barrel of the pipe to rest firmly on the bedding where bell-and-spigot pipe is used. Cut cross trenches no more than 2 in. larger than the bell ends of the pipe. Lower sections of pipe into the trench without damaging the pipe or disturbing the bedding and the sides of the trench. Carefully clean the ends of the pipe before the pipe is placed. Prevent earthen or bedding material from entering the pipe as it is laid. Lay the pipe in the trench, when elliptical pipe with circular reinforcing or circular pipe with elliptical reinforcing is used, so the markings for the top or bottom are not more than 5° from the vertical plane through the longitudinal axis of the pipe. Remove and re-lay, without extra compensation, pipe that is not in alignment or shows excessive settlement after laying.

Lay multiple lines of reinforced concrete pipe with the centerlines of the individual barrels parallel. Use the clear distances between outer surfaces of adjacent pipes shown in Table 5 unless otherwise shown on the plans. Use the equivalent diameter from Table 2 or Table 3 for arch pipe or horizontal elliptical pipe to determine the clear distance requirement shown in Table 5.

Table 5
Minimum Clear Distance Between Pipes

Equivalent Diameter	Min Clear Distance
18 in.	9 in.
24 in.	11 in.
30 in.	1 ft. 1 in.
36 in.	1 ft. 3 in.
42 in.	1 ft. 5 in.
48 in.	1 ft. 7 in.
54 in.	1 ft. 11 in.
60–84 in.	2 ft.

3.3. **Jointing**. Make available an appropriate rolling device similar to an automobile mechanic's "creeper" for conveyance through small-size pipe structures.

3.3.1. **Joints Sealed with Hydraulic Cement Mortar**. Use Type S mortar meeting the requirements of ASTM C270. Clean and wet the pipe ends before making the joint. Plaster the lower half of the bell or groove and the upper half of the tongue or spigot with mortar. Pack mortar into the joint from both inside and outside the pipe after the pipes are tightly jointed. Finish the inside smooth and flush with adjacent joints of pipe. Form a bead of semicircular cross-section over tongue-and-groove joints outside the pipe, extending at least 1 in. on each side of the joint. Form the mortar for bell-and-spigot joints to a 45° fillet between the outer edge of the bell and the spigot. Cure mortar joints by keeping the joints wet for at least 48 hr. or until the backfill has been completed, whichever is first. Place fill or backfill once the mortar jointing material has cured for at least 6 hr. Conduct jointing only when the atmospheric temperature is above 40°F. Protect mortared joints against freezing by backfilling or other approved methods for at least 24 hr.

Driveway culverts do not require mortar banding on the outside of the pipe.

Furnish pipes, with approval, that are large enough for a person to enter with the groove between 1/2 in. and 3/4 in. longer than the tongue. Such pipe may be laid and backfilled without mortar joints. Clean the space on the interior of the pipe between the end of the tongue and the groove of all foreign material, thoroughly wet and fill with mortar around the entire circumference of the pipe, and finish flush after the backfilling has been completed.

3.3.2. **Joints Using Cold-Applied, Plastic Asphalt Sewer Joint Compound**. Ensure both ends of the pipes are clean and dry. Trowel or otherwise place a 1/2-in. thick layer of the compound in the groove end of the pipe covering at least 2/3 of the joint face around the entire circumference. Shove home the tongue end of the next pipe with enough pressure to make a tight joint. Remove any excess mastic projecting into the pipe after the joint is made. Backfill after the joint has been inspected and approved.

3.3.3. **Joints Using Rubber Gaskets**. Make the joint assembly in conformance with the recommendations of the gasket manufacturer. Make joints watertight when using rubber gaskets. Backfill after the joint has been inspected and approved.

3.3.4. **Joints Using Pre-Formed Flexible Joint Sealants**. Install pre-formed flexible joint sealants in conformance with the manufacturer's recommendations. Place the joint sealer so no dirt or other deleterious materials contact the joint sealing material. Pull or push home the pipe with enough force to properly seal the joint. Remove any joint material pushed out into the interior of the pipe that would tend to obstruct the flow. Store pre-formed flexible joint sealants in an area warmed naturally or artificially to above 70°F in an approved manner when the atmospheric temperature is below 60°F. Apply flexible joint sealants to pipe joints immediately before placing pipe in trench, and connect pipe to previously laid pipe. Backfill after the joint has been inspected and approved.

3.4. **Connections and Stub Ends**. Make connections of concrete pipe to existing pipes, pipe storm drains, or storm drain appurtenances as shown on the plans.

Mortar or concrete the bottom of existing structures if necessary to eliminate any drainage pockets created by the connections. Repair any damage to the existing structure resulting from making the connections.

Make connections between concrete pipe and corrugated metal pipe with a suitable concrete collar and a minimum thickness of 4 in. unless otherwise shown on the plans.

Finish stub ends for connections to future work not shown on the plans by installing watertight plugs into the free end of the pipe.

Fill lift holes with concrete, mortar, or precast concrete plugs after the pipe is in place.

4. MEASUREMENT

This Item will be measured by the foot. Measurement will be made between the ends of the pipe barrel along the flow line, not including safety end treatments. Safety end treatments will be measured in accordance with Item 467, “Safety End Treatment.” Pipe that will be jacked, bored, or tunneled will be measured in accordance with Item 476. Measurement of spurs, branches, or new connecting pipe will be made from the intersection of the flow line with the outside surface of the pipe into which it connects. Where inlets, headwalls, catch basins, manholes, junction chambers, or other structures are included in lines of pipe, the length of pipe tying into the structure wall will be included for measurement, but no other portion of the structure length or width will be included.

For multiple pipes, the measured length will be the sum of the lengths of the barrels.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., “Plans Quantity Measurement.” Additional measurements or calculations will be made if adjustments of quantities are required.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Reinforced Concrete Pipe,” “Reinforced Concrete Pipe (Arch),” or “Reinforced Concrete Pipe (Elliptical)” of the size and D-load specified or of the size and class specified. This price is full compensation for constructing, furnishing, transporting, placing, and joining pipes; shaping the bed; cutting pipes on skew or slope; connecting to new or existing structures; breaking back, removing, and disposing of portions of the existing structure; replacing portions of the existing structure; cutting pipe ends on skew or slope; and equipment, labor, tools, and incidentals.

Protection methods for excavations greater than 5 ft. deep will be measured and paid for as required under Item 402, “Trench Excavation Protection,” or Item 403, “Temporary Special Shoring.” Excavation, shaping, bedding, and backfill will be paid for in accordance with Item 400. When jacking, boring, or tunneling is used at the Contractor’s option, payment will be made under this Item. When jacking, boring, or tunneling is required, payment will be made under Item 476.

Item 465
Junction Boxes, Manholes, and Inlets

1. DESCRIPTION

Construct junction boxes, manholes, and inlets, complete in place or to the stage detailed, including furnishing and installing frames, grates, rings, and covers.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"
- Item 471, "Frames, Grates, Rings, and Covers"

Cast-in-place junction boxes, manholes, inlets, risers, and appurtenances are acceptable unless otherwise shown on the plans. Alternate designs for cast-in-place items must be acceptable to the Engineer and must conform to functional dimensions and design loading. Alternate designs must be designed and sealed by a licensed professional engineer.

2.1. **Concrete**. Furnish concrete in accordance with DMS-7305, "Fabrication and Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Drainage Structures," for formed and machine-made precast junction boxes, manholes, and inlets. Furnish Class C concrete for cast-in-place junction boxes, manholes, and inlets unless otherwise shown on the plans.

2.2. **Mortar**. Furnish mortar conforming to DMS-4675, "Cementitious Grouts and Mortars for Miscellaneous Applications."

2.3. **Timber**. Provide sound timber that is at least 3-in. nominal thickness and reasonably free of knots and warps for temporary covers when used with Stage I construction. (Refer to Article 465.3., "Construction.")

2.4. **Other Materials**. Use commercial-type hardware as approved.

3. CONSTRUCTION

Construct all types of junction boxes, manholes, and inlets either complete or in two stages, described as Stage I and Stage II.

Construct the Stage I portion of junction boxes, manholes, and inlets as shown on the plans or as specified in this Item. Furnish and install a temporary cover as approved.

Furnish and install the storm drain pipe and a temporary plug for the exposed end of the storm drain pipe from the storm drain to a point below the top of curb indicated on the plans for Stage I construction of cast iron or steel inlet units.

Construct Stage II after the pavement structure is substantially complete, unless otherwise approved.

Construct the remaining wall height and top of junction box, manhole, or inlet for Stage II, and furnish and install any frames, grates, rings and covers, curb beams, or collecting basins required.

Construct cast-in-place junction boxes, manholes, and inlets in accordance with Item 420. Forms are required for all concrete walls. Outside wall forms for cast-in-place concrete may be omitted with approval if the surrounding material can be trimmed to a smooth vertical face.

3.1. **Precast Junction Boxes, Manholes, and Inlets**. Construct formed and machine-made precast junction boxes, manholes, and inlets in accordance with DMS-7305 and as shown on the plans, except as otherwise specified in this Item.

Multi-project fabrication plants as defined in DMS-7305 that produce junction boxes, manholes, and inlets will be approved by the Materials and Tests Division in accordance with DMS-7305. The Department's MPL has a list of approved multi-project junction box, manhole, and inlet fabrication plants.

3.1.1. **Marking**. Clearly mark each precast junction box, manhole, and inlet unit with the following information:

- name or trademark of fabricator and plant location,
- product designation,
- ASTM designation (if applicable),
- date of manufacture,
- designation "TX" for precast units fabricated in accordance with DMS-7305,
- designated fabricator's approval stamp for each approved unit, and
- designation "SR" for product meeting sulfate-resistant concrete plan requirements (when applicable).

3.1.2. **Defects and Repair**. Repair precast junction boxes, inlets, and manholes, if necessary, in accordance with the Annex of DMS-7305. Precast junction boxes, inlets, and manholes may be rejected for any of the conditions stated in this Annex.

3.1.3. **Storage and Shipment**. Store precast units on a level surface. Do not ship units until design strength requirements have been met.

3.2. **Excavation, Shaping, Bedding, and Backfill**. Excavate, shape, bed, and backfill in accordance with Item 400, "Excavation and Backfill for Structures." Immediate backfilling is permitted for all junction box, manhole, and inlet structures where joints consist of rubber boots, rubber gaskets, or bulk or preformed joint sealant. Take precautions in placing and compacting the backfill to avoid any movement of junction boxes, manholes, and inlets. Remove and replace junction boxes, manholes, and inlets damaged by the Contractor at no expense to the Department.

3.3. **Junction Boxes, Manholes, and Inlets for Precast Concrete Pipe Storm Drains**. Construct junction boxes, manholes, and inlets for precast concrete pipe storm drains before completion of storm drain lines into or through the junction box, manhole, or inlet. Neatly cut all storm drains at the inside face of the walls of the junction box, manhole, or inlet.

3.4. **Junction Boxes, Manholes, and Inlets for Box Storm Drains**. Place bases or risers of junction boxes, manholes, and inlets for box storm drains before or in conjunction with placement of the storm drain. Backfill the junction box, manhole, or inlet and storm drain as a whole.

3.5. **Inverts**. Shape and route floor inverts passing out or through the junction box, manhole, or inlet as shown on the plans. Shape by adding and shaping mortar or concrete after the base is placed or by placing the required additional material with the base.

3.6. **Finishing Complete Junction Boxes, Manholes, and Inlets**. Complete junction boxes, manholes, and inlets as shown on the plans. Backfill to original ground elevation in accordance with Item 400.

3.7. **Finishing Stage I Construction**. Complete Stage I construction by constructing the walls to the elevations shown on the plans and backfilling to required elevations in accordance with Item 400.

3.8. **Stage II Construction**. Construct subgrade and base course or concrete pavement over Stage I junction box, manhole, or inlet unless otherwise approved. Excavate to expose the top of Stage I construction and complete the junction box, manhole, or inlet as shown on the plans and in accordance with these specifications, including backfill and cleaning of all debris from the bottom of the junction box, manhole, or inlet.

3.9. **Inlet Units**. Install cast iron or steel inlet units in conjunction with the construction of concrete curb and gutter. Set the inlet units securely in position before placing concrete for curb and gutter. Form openings for the inlets and recesses in curb and gutter as shown on the plans. Place and thoroughly consolidate concrete for curb and gutter adjacent to inlets and around the inlet castings and formed openings and recesses without displacing the inlet units.

4. MEASUREMENT

All junction boxes, manholes, and inlets satisfactorily completed as shown on the plans and in conformance with specifications will be measured by each junction box, manhole, or inlet complete, or by each junction box, manhole, or inlet completed to the stage of construction required by the plans.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for as follows.

5.1. **Complete Manholes**. Payment for complete manholes will be made at the unit price bid for "Manhole (Complete)" of the type specified.

5.2. **Complete Inlets**. Payment for inlets will be made at the unit price bid for "Inlet (Complete)" of the type specified.

5.3. **Complete Junction Boxes**. Payment for junction boxes will be made at the unit price bid for "Junction Box (Complete)" of the type specified.

5.4. **Manholes Stage I**. Payment for manholes, Stage I, will be made at the unit price bid for each "Manhole (Stage I)" of the type specified.

5.5. **Manholes Stage II**. Payment for manholes, Stage II, will be made at the unit price bid for each "Manhole (Stage II)" of the type specified.

5.6. **Inlets Stage I**. Payment for inlets, Stage I, will be made at the unit price bid for each "Inlet (Stage I)" of the type specified.

5.7. **Inlets Stage II**. Payment for inlets, Stage II, will be made at the unit price bid for each "Inlet (Stage II)" of the type specified.

5.8. **Junction Boxes Stage I**. Payment for junction boxes, Stage I, will be made at the unit price bid for each "Junction Box (Stage I)" of the type specified.

5.9. **Junction Boxes Stage II**. Payment for junction boxes, Stage II, will be made at the unit price bid for each "Junction Box (Stage II)" of the type specified.

These prices are full compensation for concrete, reinforcing steel, mortar, frames, grates, rings and covers, excavation, and backfill, and for all other materials, tools, equipment, labor, and incidentals.

Item 479
Adjusting Manholes and Inlets

1. DESCRIPTION

Adjust or cap existing manholes or inlets. Drainage junction boxes will be classified as manholes.

2. MATERIALS

Reuse removed manhole and inlet rings, plates, grates, and covers if they are in good condition as determined by the Engineer. Provide additional materials in accordance with Item 465, "Junction Boxes, Manholes, and Inlets," at no cost to the Department. Use single- or multiple-piece prefabricated metal, polymer, plastic, or rubber extension rings for the adjustment of manholes as approved. Limit the height of flexible extension rings to 3 in. Provide concrete that meets Item 421, "Hydraulic Cement Concrete."

Ensure frames and grates or rings and covers above grade are of single-piece cast iron manufactured in accordance with Item 471, "Frames, Grates, Rings, and Covers." Provide steel riser material compliant with ASTM A36. Provide steel adjustable risers that include a stainless steel adjustable stud with positive lock that adjusts the diameter ±3/8 in. Provide steel risers that include a minimum of three Allen head set screws that lock the riser to the manhole or catch basin frame. Ensure seating surfaces are flat and true and provide a non-rocking seating surface.

3. CONSTRUCTION

Perform all work in accordance with Item 465. Excavate and backfill in accordance with Item 400, "Excavation and Backfill for Structures." Carefully remove manhole and inlet rings, covers, plates, and grates to be reused. Clean mortar and grease from the contact areas of all reused items. Dispose of unused removed material as directed. Use construction methods described in Section 479.3.1., "Lowering the Top of a Manhole or Inlet," and Section 479.3.2., "Raising the Top of a Manhole or Inlet," unless otherwise shown on the plans.

3.1. **Lowering the Top of a Manhole or Inlet**. Remove a sufficient depth of brick courses or concrete to permit reconstruction on a batter not exceeding 1 in. horizontal to 2 in. vertical. Clean the mortar from the top course of brick where brickwork is present. Rebuild the manhole or inlet to the original top dimensions or to the dimensions shown on the plans. Install the manhole or inlet ring and the cover, plate, or grate to conform to the proposed new surface contour.

3.2. **Raising the Top of a Manhole or Inlet**. Clean the top surface of brick or concrete. Construct to the proper new elevation using new rubber extension rings, concrete rings, or Class A concrete. Provide rubber manhole and catch basin risers of minimum 80% by weight recycled rubber and minimum 10% by volume recycled resorcinol-formaldehyde-latex (RFL) coated fiber. Provide rubber manhole and catch basin adjustment risers that are of uniform quality, free of cracks, holes, and any other surface defects. Construction must be suitable for AASHTO H20 live loads. Load certifications for materials will be made available upon request. Install the manhole or inlet ring and the cover, plate, or grate to conform to the proposed new surface contour. Install prefabricated extension rings in conformance with manufacturer's instructions.

3.3. **Capping an Inlet or Manhole**. Remove the inlet or manhole to a minimum of 1 ft. below subgrade elevation or as shown on the plans. Cap as shown on the plans.

4. MEASUREMENT

Adjusted or capped manholes or inlets will be measured as each manhole or inlet adjusted.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Adjusting Manholes," "Adjusting Inlets," or "Adjusting Manholes and Inlets." This price is full compensation for materials, including backfill as required, and for excavation, tools, equipment, labor, and incidentals.

Item 481
Pipe for Drains

1. DESCRIPTION

Furnish and install pipe for drains.

2. MATERIALS

Furnish polyvinyl chloride (PVC) pipe meeting the requirements of ASTM D1785, Schedule 40, and furnish PVC fittings meeting the requirements of ASTM D2466. PVC pipe and fittings meeting the requirements of ASTM D3034 Type SDR-35 may be used for installations encased in concrete or buried in soil.

Furnish a manufacturer's certification stating the material meets the appropriate ASTM specification.

Furnish pipe marked with:

- manufacturer's name or trademark and code;
- nominal size;
- PVC cell classification (e.g., 12454-B);
- schedule or other legend (e.g., SDR-35 PVC Sewer Pipe); and
- specification designation (e.g., ASTM D1785).

Furnish fittings marked with:

- manufacturer's name or trademark;
- nominal size;
- material designation (if using ASTM D2466) (e.g., PVC) or PVC cell classification (if using ASTM D3034); and
- other legend (if using ASTM D3034) (e.g., SDR-35) and specification designation (e.g., ASTM D3034).

Furnish solvent meeting the requirements of ASTM D2564 for solvent-welding of fittings.

Provide other types of pipe and fittings as specified.

Provide fittings, hangers, clamps, straps, anchors, and guard plates as shown on the plans.

3. CONSTRUCTION

Excavate and backfill for pipe installation in accordance with Item 400, "Excavation and Backfill for Structures." Install pipe as shown on the plans or as directed. Solvent-weld all fittings, including splice fittings, to provide a watertight fit. Do not splice straight sections of pipe at intervals shorter than 20 ft. unless at the end of a run or otherwise approved.

Degrease all exposed PVC pipe and fittings, and apply an acrylic water-based primer followed by a coating of the same color used for adjacent concrete surface, unless otherwise shown on the plans.

Install other types of pipe (material other than PVC) in conformance with manufacturer's specifications.

4. MEASUREMENT

This Item will be measured by the foot along the centerline of the installed pipe of the nominal size shown on the plans.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Pipe" of the sizes and types specified. This price is full compensation for furnishing and installing the pipe and for fittings, hangers, clamps, straps, anchors, guard plates, painting, equipment, labor, tools, and incidentals. Excavation and backfill will not be paid for directly, but will be subsidiary to this Item.

550 – CHAIN LINK FENCE

1.0 GENERAL

550.1. Description. Furnish, install, remove, repair, or replace chain link fence and gates.

550.2. Materials. Before installation of the chain link fence, furnish certification from the fence materials manufacturer stating that all fencing materials comply with the requirements of this Item. Use only new materials.

A. General. Furnish materials in accordance with the following:
- Item 421, "Hydraulic Cement Concrete," Class B
- Item 445, "Galvanizing."

B. Wire Fabric. Provide wire fabric with:
- 9 gauge (0.148 in. diameter) steel wire with a minimum breaking strength of 1,290 lb. meeting ASTM A 392 Class I or ASTM A 491;
- mesh size of 2 in. ±1/8 in. between parallel wires with at least 7 meshes in a vertical dimension of 23 in. along the diagonals of the openings; and
- knuckled selvages at the top and bottom edge of the fabric, unless otherwise shown on the plans.

C. Posts. Provide posts of the size and weight shown on the plans. Do not provide rerolled or open-seam posts. Use material meeting ASTM F 1083 for all posts. When specified, furnish thin-wall, high- strength pipe posts manufactured by cold rolling using steel strip conforming to ASTM A 1011, CS (Commercial Steel).

D. Post Caps. Provide malleable iron post caps designed to exclude all moisture. If barbed wire is shown on the plans, furnish barbed wire support arms integral with the post caps. If top rail is shown on the plans, furnish post caps with an opening for the top rail. Post caps must have a 2-in. skirt.

E. Gates. Provide gates fabricated from round sections of pipe of the size and weight shown on the plans.
Use material meeting ASTM F 1083 for all gate pipes. For each gate, include:
- corner and tee fittings of malleable iron or pressed steel with means for attaching diagonal bracing members;
- hinges of malleable iron allowing a full 180° swing, easily operated by one person;
- ball-and-socket-type bottom hinges that do not twist or turn from the action of the gate and prevent the closed gate from being lifted off the hinges;
- a positive stop that prevents any portion of the gate from swinging over an adjacent traffic lane;
- malleable iron pulley systems for roll type gate (only when required);
- diagonal braces consisting of 3/8-in.-diameter cable with turnbuckles, 2 to each gate frame, and, for vehicle gates, a vertical pipe brace of the size and weight shown on the plans at the center of each gate leaf;
- latches of malleable iron or steel for single gates with a single-fork latch and padlock eye that will keep the gate closed;

- two fork latches mounted on a center plunger rod with a padlock eye for double-leaf gates;
- holdbacks for each leaf of vehicular gates, with a semi-automatic holdback catch anchored at least 12 in. into a 12 in.-diameter by 24 in.-deep concrete footing; and
- a malleable iron center rest, designed to receive the plunger rod anchored as shown on the plans for all double-leaf gates.

F. Top Rail. When shown on the plans, provide top rail manufactured from 1.660 in. OD standard weight (Schedule 40) steel pipe weighing 2.27 lb. per foot or high-strength pipe weighing 1.82 lb. per foot. Use material meeting ASTM F 1083 for all top rail pipes. Provide pipe in sections at least 18 ft. long joined with outside steel sleeve couplings at least 6 in. long with a minimum wall thickness of 0.70 in. Use couplings designed to allow for expansion of the top rail.

G. Tension Wire. Use 7 gauge (0.177-in.) carbon steel wire with a minimum breaking strength of 1,950 lb. for the bottom edge of all fence fabric, and for the top edge of fence fabric when a top rail is not specified.

H. Truss Bracing. Provide truss bracing as shown on the plans.

I. Cables. Provide 7-wire strand cables manufactured of galvanized annealed steel at least 3/8 in. in diameter.

J. Barbed Wire. When specified on the plans, provide 3 strands of twisted 12.5 gauge barbed wire with 2-point, 14 gauge barbs spaced approximately 5 in. apart conforming to ASTM A 121 or ASTM A 585.

K. Barbed Wire Support Arms. When barbed wire is specified on the plans, provide support arms at an angle of 45° from vertical, with clips for attaching 3 strands of barbed wire to each support arm and sufficient strength to support a 200-lb. weight applied at the outer strand.

L. Stretcher Bars. Provide stretcher bars made of flat steel at least 3/16 in. by 3/4 in. and not more than 2 in. shorter than the fabric height. Provide 1 stretcher bar for each gate and end post and 2 stretcher bars for each corner and pull post.

M. Grounds. Provide copper-clad steel rods 8 ft. long with a minimum diameter of 5/8 in., or other UL- listed ground rods.

N. Miscellaneous Fittings and Fasteners. Furnish in sufficient quantities to erect all fencing materials in a proper manner. Furnish fittings for posts from pressed or rolled steel, forged steel, malleable iron or wrought iron of good commercial quality spaced as shown on the plans.

O. Coatings. Unless specified on the plans, hot-dip galvanize all materials. Fabric, tension wire, and barbed wire may be aluminum-coated or alloy-coated if approved. When shown on the plans, additionally coat all material except bolts, nuts, and washers with thermally fused polyvinyl chloride (PVC) in accordance with

ASTM F 668, Class 2B, meeting the specified color.

1. **Fabric.**
   a. **Galvanizing.** Hot-dip galvanize in accordance with ASTM A 392, Class I.
   b. **Aluminum Coating.** Aluminum-coat in accordance with ASTM A 491.
   c. **Alloy Coating.** Coat with zinc-5% aluminum-mischmetal alloy (Zn-5A1-MM) in accordance with ASTM F 1345, Class I.
2. **Posts.**
   a. **Inside and Outside Galvanizing.** Hot-dip galvanize inside and outside in conformance with ASTM F 1083.
   b. **Alloy Coating.** Coat inside and outside with Zn-5A1-MM in accordance with ASTM F 1043, Class C.
3. **Braces and Gates.**
   a. **Galvanizing.** Hot-dip galvanize braces and gates inside and out in conformance with ASTM F 1083.
   b. **Alloy Coating.** Coat inside and out with (Zn-5A1-MM) in accordance with ASTM F 1043, Class C.
4. **Fittings, Bolts, and Other Miscellaneous Hardware.** Galvanize all fittings, bolts and miscellaneous hardware in conformance with Item 445, "Galvanizing."
5. **Tension Wire.** Zinc-coat tension wire with a minimum coating of 0.80 oz./sq. ft. or aluminum- coat with a minimum coating of 0.30 oz./sq. ft.
6. **Barbed Wire.** Zinc-coat barbed wire in accordance with ASTM A 121 (0.80 oz./sq. ft.) or aluminum-coat in accordance with ASTM A 585 (0.30 oz./sq. ft.).
7. **Pull Cable.** Zinc-coat pull cable with a minimum coating of 0.80 oz./sq. ft. of individual-wire surface when tested in conformance with ASTM A 116.

550.3. Construction. Erect the chain link fence to the lines and grades established on the plans. Overall height of the fence when erected is the height above the grade shown. Repair or replace damaged fence or gates. If posts cannot be repaired by straightening, remove and replace the post and foundation. When a fence installation is to be removed in its entirety and not replaced, return all salvageable material to the location shown on the plans. Backfill all postholes with suitable material. Return the salvaged fence fabric in secured rolls not more than 50 ft. long. Dispose of unsalvageable material.

A. Clearing and Grading. Clear all brush, rocks, and debris necessary for the installation of this fencing.

Unless otherwise shown on the plans, stake the locations for corner posts and terminal posts. Follow the finished ground elevations for fencing panels between corner and terminal posts. Level off minor irregularities in the path of the fencing.

B. Erection of Posts. Install posts as shown on the plans. Plumb and permanently position posts with anchorages firmly set before fabric is placed. Brace corner and pull posts as shown on the plans.

1. **Post Spacing.** Space posts as shown in Table 1.

Table 1
Post Spacing and Placement

Post Type	Required Spacing or Placement
Line posts	at most 10 ft. apart

Pull posts	at most 500 ft. apart and at each change in direction exceeding 20° vertically
Corner posts	at each horizontal angle point

Install cables on all terminal posts and extend to adjacent posts. Install cables on each side of corner and pull posts with a 3/8-in. drop-forged eye-and-eye or eye-and-clevis turnbuckle, unless otherwise shown on the plans.

2. **Postholes.** Drill holes for concrete footings for all posts to provide footings of the dimensions shown on the plans.
   Where solid rock is encountered before reaching plan depth, penetrate the solid rock by at least 12 in. (18 in. for end, corner, gate, and pull posts) or to plan depth. Drill holes in the solid rock with a diameter at least 1 in. greater than the outside diameter of the post.
   After the posts are set and plumbed, fill the hole in the solid rock with grout consisting of 1 part hydraulic cement and 3 parts clean, well-graded sand. Other grouting materials may be used if approved. Thoroughly work the grout into the hole, leaving no voids. Construct concrete footings from the solid rock to the top of the ground.
3. **Gate Posts.** Align the tops of all gate frames with the fencing top tension wire or top rail. If curbs are shown on the plans, provide vehicular gates that are greater in overall height than the adjacent fencing by the height necessary to extend to within 2 in. of the pavement between the curbs.
4. **Concrete Footings.** Center posts in their footings. Place concrete and compact by tamping or other approved methods. Machine mix all batches of concrete over 1/2 cu. yd. Hand mixing concrete is allowed on batches under 1/2 cu. yd.
   Use forms for footings where the ground cannot be satisfactorily excavated to neat lines. Crown the concrete or grout (for solid rock) to carry water from the post. Keep the forms in place for at least 24 hr. Backfill the footing with moistened material as soon as each form is removed, and thoroughly tamp. Cover concrete with at least 4 in. of loose moist material, free of clods and gravel, immediately after placing concrete. No other curing is required.
   Spread all excess excavated and loose material used for curing neatly and uniformly. Remove excess concrete and other construction debris from the site.

C. Erection of Fabric. After all posts have been permanently positioned and anchorages firmly set, place the fabric with the cables drawn taut with the turnbuckles. Secure one end and apply enough tension to the other end to remove all slack before making attachments. Unless otherwise shown on the plans, cut the fabric and independently attach each span at all corner posts and pull posts.
Follow the finished contour of the site with the bottom edge of fabric located approximately 2 in. above the grade. Grade uneven areas so the maximum distance between the bottom of fabric and ground is 6 in. or less.
Fasten fabric at 12 in. intervals to the top and bottom tension wires between posts. When top rail is shown on the plans, fasten the fabric in the same manner. On gate frames, fasten the fabric to the top and bottom of the gate frame at 12 in. intervals. Use steel wire fabric ties of 9 gauge steel or larger. Fasten fabric to terminal posts by steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing shown on the plans. Use stretcher bars to fasten endposts, pull posts, corner posts, and gateposts with stretcher bar bands at intervals of at most

15 in. Attach stretcher bars to terminal posts with 1 in. × 1/8 in. flat steel bands with 3/8-in. carriage bolts at intervals up to 15 in.

D. Electrical Grounds. Provide at least 1 electrical ground for each 1,000 ft. of fence, located near the center of the run. Provide additional grounds directly under the point where power lines pass over the fence.
Vertically drive or drill in the grounding rod until the top of the rod is approximately 6 in. below the top of the ground. Connect a No. 6 solid copper conductor to the rod and to the fence by a UL-listed method so that each element of the fence is grounded.

E. Repair of Coatings. Repair damaged zinc coating in accordance with Section 445.3.D, "Repairs."

550.4. Measurement. Chain link fence will be measured by the foot of fence installed, repaired, replaced, or removed, measured at the bottom of the fabric along the centerline of the fence from center to center of posts, excluding gates.
Gates will be measured as each gate installed, repaired, replaced, or removed.

550.5. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Chain Link Fence (Install)" or "Chain Link Fence (Repair)"of the height specified or "Chain Link Fence (Remove)" and "Gate (Install)" or "Gate (Repair)" of the type, height, and width of opening specified or "Gate (Remove)." Clearing and grading for fencing and gates will not be paid for directly but is subsidiary to this Item.

A. Chain Link Fence (Install). This price is full compensation for furnishing and installing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.

B. Chain Link Fence (Repair). This price is full compensation for furnishing materials; repairing or replacing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus or damaged material; and equipment, labor, tools, and incidentals.

C. Chain Link Fence (Remove). This price is full compensation for removing all fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.

D. Gate (Install). This price is full compensation for installing gate and for providing materials, center anchorages, equipment, labor, tools, and incidentals.

E. Gate (Repair). This price is full compensation for repairing or replacing gate and for furnishing materials; removing and disposing of damaged materials; and equipment, labor, tools, and incidentals.

F. Gate (Remove). This price is full compensation for removing gate and for materials, equipment, labor, tools, and incidentals.

END OF SECTION

Item 752
Tree and Brush Removal

1. DESCRIPTION

Remove and dispose of trees, brush, shrubs, and vines. Trim trees and shrubs. Remove stumps.

2. MATERIALS

Furnish commercially available pruning paint.

3. EQUIPMENT

Provide equipment necessary to complete the work.

4. WORK METHODS

Perform tree and brush removal and trimming from right of way line to right of way line or other widths and locations shown on the plans. Ensure trees, shrubs, and other landscape features that are to remain are not damaged. Dispose of debris within 48 hr. of cutting, off the right of way, in conformance with federal, state, and local regulations unless otherwise approved. When approved, chip debris and spread in a thin layer on the right of way.

4.1. **Tree Removal**. Remove trees of various diameters as shown on the plans, or as directed. Remove tree stumps to at least 12 in. below the surrounding terrain unless otherwise shown on the plans, or as directed. Backfill holes with acceptable material and compact flush with surrounding area.

4.2. **Tree Trimming**. Remove dead tree limbs. Remove tree limbs to the limits shown on the plans. Prune trees in accordance with ANSI A300 Standard Practices for shade trees. Make cuts as close as possible to the trunk or parent limb without cutting into the branch collar or leaving a protruding stub. Remove suckers to the height of the lowest main branch.

When removing limbs 2 in. in diameter or larger:

- undercut 1/3 way through the limb 8–12 in. from the main stem,
- remove limb 4–6 in. outside the first cut,
- remove stub with an even flush cut so that a trace (collar) protrudes approximately 1/2 in.,
- do not allow limb to fall free if it can damage other limbs or items, and
- treat exposed cuts on oak trees with wound dressing within 20 min. of the cut.

Disinfect tools using 70% methyl alcohol, benzalkonium chloride, chlorine solution, or other approved disinfectant when trimming oak trees and when shown on the plans before cutting and sterilize or sanitize again before cutting another tree. Avoid pruning between February 15 and June 15, the period for maximum insect and fungal activity.

4.3. **Brush Removal**. Remove brush including, but not limited to, bushes, small trees, and vines growing within the right of way by cutting parallel to and within 1 in. of the ground and to the limits shown on the plans. Remove brush from under bridges, around culverts, and in channels to the limits shown on the plans.

4.4. **Channel Work**. Trim trees and remove brush to the limits shown on the plans, including areas under bridges and easements.

4.5. **Stump Removal**. Remove tree stumps at least 12 in. below the surrounding terrain unless otherwise shown on the plans, or as directed. Backfill holes with acceptable material and compact flush with surrounding area.

4.6. **Spot Tree Trimming and Brush Removal**. Trim trees in accordance with Section 752.4.2., "Tree Trimming," and remove brush in accordance with Section 752.4.3., "Brush Removal."

5. MEASUREMENT

This Item will be measured as follows.

5.1. **Tree Removal**. By each tree of the diameter specified. The diameter will be measured 3 ft. above the ground. Trees less than 4 in. in diameter are considered brush. Trees with multiple trunks at the point of measurement will be measured separately and paid for according to the specified diameter. Removal of the stump will be subidiary to "Tree Removal."

5.2. **Tree Trimming and Brush Removal**. By the centerline mile of the dimension specified. "Centerline mile" is defined as the continuous measurement along the center of the right of way.

5.3. **Tree Trimming and Brush Removal for Channels**. By the acre.

5.4. **Stump Removal**. By each stump removed. This Item is for stumps where others previously removed the tree.

5.5. **Spot Tree Trimming and Brush Removal**. **"**Brush Removal" will be measured by the foot along the length of the right of way. "Tree Trimming" will be measured by the foot along the length of the right of way to the outer edges of the tree canopy. For areas with tree trimming and brush removal, use the greatest length combination along the right of way.

6. PAYMENT

The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Tree Removal" of the diameter specified, "Tree Trimming" of the dimension specified, "Brush Removal," "Tree Trimming and Brush Removal," "Stump Removal," and "Spot Tree Trimming and Brush Removal." This price is full compensation for removal, trimming, disposal, equipment, traffic control, labor, and incidentals.

When not shown on the plans as a separate pay item, payment for tree trimming and brush removal in channels will be included in payment by the centerline mile. When shown on the plans as a separate pay item, tree trimming and brush removal in channels will be paid for at the unit price bid for "Tree Trimming and Brush Removal (Channels)."

The limits shown on the plans are the limits for pay purposes unless otherwise modified in accordance with Article 4.4., "Changes in the Work."

Special Specification 7042
Slip-in Inline Check Valves

1. DESCRIPTION

1.1. Furnish and install slip-in inline check valve in compliance with manufacturer installation requirements.

1.2. Function of Valve: When line pressure exceeds the backpressure, the line pressure forces the bill and saddle of the valve open, allowing flow to pass. When the backpressure exceeds the line pressure, or in the absence of any upstream or downstream pressure, the bill and saddle of the valve is forced closed, preventing backflow.

1.3. Manufacturer must have flow test data from an accredited hydraulics laboratory to confirm pressure drop and hydraulic data.

1.4. Company name, plant location, valve size patent number, and serial number must be bonded to the check valve.

1.5. All valves must be manufactured in the U.S.A.

2. MATERIALS

2.1. Check valves are to be all rubber and the flow operated check type with slip-in cuff connection. The entire valve must be ply reinforced throughout the body, saddle and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable. The valve must be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure any component of the valve to a valve housing. The port area of the saddle must contour into a circumferential sealing area concentric with the pipe which must allow passage of flow in one direction while preventing reverse flow. The entire valve must fit within the pipe inside diameter. The saddle area of the valve must be flat, not conical, and integral with the rubber body above centerline in order to not produce any areas or voids that can collect or trap debris. The valve must be easily installed in pipes with poor end condition without the need to modify or utilize the headwall or structure to seal and anchor the valve. Once installed, the valve must not protrude beyond the face of the structure or end of the pipe.

2.2. The outside diameter of the upstream and downstream sections of the valve must be circumferentially in contact with the inside diameter of the pipe.

2.3. Slip-in style valves will be furnished with a set of stainless steel expansion clamps. The clamps, which will secure the valve in place, must be installed in the upstream or downstream cuff of the valve, depending on installation orientation, and must expand outwards by means of a turnbuckle. Each band must be pre-drilled allowing for the valve to be pinned and secured into position in accordance with the manufacturer's installation instructions. Valve must be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.

3. EQUIPMENT

3.1. Manufacturer's authorized representative must be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

3.2. Submit product literature that includes information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, headloss, flow data and pressure ratings.

4. CONSTRUCTION

Valve must be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.

5. MEASUREMENT

This item will be measured as each diameter slip-in inline check valve installed.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for under the unit bid price for Slip-in Inline Check Valves (complete in-place)." This is full price for installing check valve. Any tools or incidentals needed to accomplish this will not be paid for separately, but will be considered subsidiary to this bid Item.

SECTION 312216 – FINE GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavate to line, grade and configuration as shown in the plans and specifications for proposed and future pavement areas.

B. Fill to line, grade and configuration as shown in the plans and specifications for proposed and future pavement areas.

C. Compacting fill materials in an acceptable manner as stated herein.

1.2 RELATED SECTIONS

A. Section 31 23 00 – Earthwork

B. Section 32 16 00 – Curbs and Gutters

C. Geotechnical Report (if available) for Boring Locations and Findings of Subsurface Materials and Conditions.

D. Construction Drawings

1.3 REFERENCE STANDARDS

A. AMERICAN Society for Testing and Materials (ASTM) latest edition.
- D 422 Method for Particle Size Analysis of Soils
- D 698 Test for Moisture-Density Relations of Soils Using 5.5 lb (2.5 kg) Rammer and 12-inch (304.8 mm) Drop (Standard Proctor)
- D 1556 Test for Density of soil in place by the Sand Cone Method.
- D 1557 Test for Moisture-Density Relations of Soils using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) Drop (Modified Proctor).
- D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- D 2167 Test for Density of Soil in place by the Rubber Balloon Method.
- D 2216 Laboratory Determination of Moisture content of Soil.
- D 2487 Classification of Soils for Engineering Purposes.
- D 2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D 4318 Test for Plastic Limit, Liquid, Limit, and Plasticity Index of Soils.
C 25 Chemical Analysis of Limestone, Quicklime and Hydrated Lime.
C 110 Physical Testing for Quicklime and Hydrated Lime, Wet Sieve Method.
C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
C 997 Quicklime and Hydrated Lime for Soil Stabilization

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition T 88 Mechanical Analysis of Soils.

1.4 QUALITY ASSURANCE

A. Independent Testing Laboratory paid by Contractor, shall be retained to perform construction on filling operation and subgrade analysis as specified in Section 31 23 00 and as stated herein.

1.5 SUBMITTALS

A. Shop Drawings or details pertaining to excavating and filling for Pavement are not required unless otherwise shown on the drawing or Specifications or if contrary procedures to the project document are proposed.

B. Submit a sample of each type of off-site fill materials that is to be used in backfilling in tan air-tight, 10 lb container for testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Fill material from on-site as specified in Section 31 23 00 and approved by the Owner or Owner's Representative.
B. Acceptable stabilization fabrics and geogrids:
   1. Mirafi 500X or 600X
   2. Phillips 66 Supac 6WS
   3. Dupont Typar 3401 and 3601
   4. Trevira S1114 and S1120
   5. Tensar SS-1 and SS-2
   6. Exxon GTF-200 or 350

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify all lines, elevations and grades necessary to construct pavements, curb and gutter, bases, walkways and roadways as shown in the plans and specifications.

B. Carefully protect benchmarks, property corners, monuments or other reference points.

C. Locate and identify all site utilities that have previously been installed and may be in danger of damage by grading operations.

D. Locate and identify all existing utilities that are to remain and protect them from damage.

3.2 EXCAVATION

A. Excavate roadway ad pavement areas to line and grade as shown in the plans and specifications.

B. Engage all suitable material into the project fill areas as specified in Section31 23 00.

C. Unsuitable excavated material is to be disposed of in manner and location that is acceptable to the owner and local governing agencies.

D. Perform excavation using capable, well maintained equipment and methods acceptable to the owner and the project document requirements.

3.3 FILLING AND SUBGRADE PREPARATION

A. Areas exposed by excavation or stripping and on which subgrade preparations for paving are to be performed, including future pavement areas, shall be scarified to minimum depth of 8” and compacted to minimum of 95% of optimum density, in accordance with ASTM D698 (or 92% of optimum density, in accordance with ASTM D1557), at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content. These areas shall then be proof rolled to detect any areas of insufficient compaction. Proof rolling shall be accomplished by making a minimum of two (2)

complete passes with a fully-loaded tandem-axle dump truck, or approved equivalent, in each of the two perpendicular directions under the supervision and direction of a field Geotechnical Engineer. Areas of failure shall be excavated and re-compacted as stated above.

B. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8" loose measure and compacted to a minimum density of 95% of optimum density, in accordance with ASTM D698, (or 92% of the optimum density, in accordance with ASTM D1557) at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content.

C. The following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used in the specified areas, unless specifically stated otherwise on the drawings.

	PI	LL
*Paving Area, below upper two feet	20	50
*Paving Area, upper two feet	15	40

(*References to depth are to proposed subgrde elevations.)

D. Material imported from off-site shall have a CBR (California Bearing Ratio) or LBR (Limerock Bearing Ratio) value equal to or above the pavement design subgrade CBR or LBR value indicated on the drawings.

3.4 COMPACTION

A. Maintain optimum moisture content of fill materials to attain required compaction density.

B. All materials shall be tested in accordance with Section 3 23 00.

C. An independent testing laboratory selected and paid by the Owner, shall be retained to perform testing on-site.

D. Compaction test will be as specified in Section 3 23 00 together with the following for paving areas:
   1. In cut areas not less than one compaction tests for every 10,000 square feet.
   2. In fill areas, same rate of testing for each 8" lift (measured loose).

E. If compaction requirements are not complied with at any time during construction process, remove and re-compact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction including concrete trucks and dump trucks.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on-site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 3 23 00 and as more specifically stated herein.

B. Grading of paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerances of 0.10 feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations. Contractor to acquire, and not cost to the Owner, the services of a Professional Engineer or Registered Land Surveyor to provide field staking and verify finished grade elevations.

END OF SECTION

(Referenced from 2004 TxDOT, ITEM 168 Vegetative Watering – references made to any other Sections of the 2004 TxDOT Manual shall become part of the Contract to be followed)

00168.1. Description. Provide and distribute water to promote growth of vegetation as directed.

00168.2. Materials. Use water that is clean and free of industrial wastes and other substances harmful to the growth of vegetation.

00168.3. Construction. Apply water when directed. Furnish and operate equipment to distribute water at a uniform and controllable rate. Ensure that watering does not erode soil or plantings. Apply water in the required quantity where shown on the plans or as directed.

00168.4. MEASUREMENT AND PAYMENT

A. When listed as a separate contract pay item, shall be measured in accordance with "Measurement and Basis of Payment" section or as shown on the Bid Proposal Form.

B. When not listed as a separate contract pay item, shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 328000 - IRRIGATION

PART 1 -GENERAL

1.01 SYSTEM DESIGN

A. The irrigation system outlined on the Drawings indicates areas to be irrigated, but the sprinkler and drip irrigation systems must be designed by a licensed professional.
B. The Contractor must submit the credentials for said professional for approval prior to proceeding with irrigation systems design and installation.
C. The design plans shall be prepared by the approved professional, signed, stamped, and submitted for approval. Once approved, the irrigation system construction may begin.

1.02 WORK INCLUDED

A. Trenching and other excavation.
B. Irrigation lines, valve control circuits and appurtenances.
C. Irrigation controllers and remote control valves.
D. Electrical service and service installation if required.
E. Testing.
F. Backfill and compaction of backfill.
G. Dust alleviation and control.
H. Cleanup and disposal.
I. Supplying all labor, materials, equipment, and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.03 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the general designation only.
B. American Society for Testing and Materials (ASTM) Publications:
C. D -1785, Pipe, Polyvinyl Cholride (PVC) Plastic Schedules 40, 80 and 120.
D. D-1784, Pipe, Polyvinyl Cholride (PVC) Plastic Class 200.

1.04 QUALITY ASSURANCE

A. Irrigation mains, lines and appurtenances shall be subject to successfully passing a leakage test as prescribed herein.
B. Irrigation lines shall be installed after satisfactory completion of roadway or landscape subgrade.

C. Submit catalogue cuts of irrigation valves, controllers, and associated equipment for approval.

1.05 JOB CONDITIONS

A. Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, and any adjacent property owners or tenants.
B. Locations for proposed irrigation controllers and/or electrical service points shown on the plans are approximate only and the exact locations for such shall be as established in the field by the Engineer.
C. Damage resulting from movement of the sides or bottom of trenches or other excavation which is attributable to the Contractor's acts or omissions, whether sides are braced or not, and any portions of the area and work affected by such movement, shall be satisfactorily repaired or restored.
D. Contractor shall supply and deliver the following equipment and information prior to acceptance of the work:
   1. Three (3) each (if applicable) quick coupler valve keys and hose swivel ells.
   2. Two (2) sets of various special wrenches or tools that may be required for adjustment of sprinkler heads or equipment.
   3. Three (3) (if applicable) keys or wheel handles required to operate hose bibs.
   4. Two (2) copies of the instruction manual for each irrigation controller.
E. Comply and conform with conditions and requirements indicated under Section 02202, Trenching and Backfill, of these Specifications.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS FOR IRRIGATION MAINS

A. Pressure mains and non-pressure mains shall be polyvinyl chloride (PVC) Schedule 40 conforming to the requirements of ASTM Designation D1785 or Class 200 (ASTM D1784) and shall be provided with solvent weld joints and fittings.
B. All plastic fittings shall be Schedule 40 polyvinyl chloride (PVC) conforming to the requirements of ASTM Designation D1785 or Class 200 (ASTM D1784) and shall be specifically made for the type of pipe used.
C. All nipples and fittings for risers shall be Schedule 80 polyvinyl-chloride (PVC) conforming to the requirements of ASTM Designation D1785. Nipples, fittings and risers shall be same size as sprinkler head inlets.
D. All polyvinyl chloride (PVC) pipe and fittings shall be free from

imperfections.

E. Metallic nipples and fittings for above-ground installation of backflow preventer systems shall be Schedule 40 or Class 200 brass nipples and class 125# bronze fittings. All brass nipples and bronze fittings shall be factory threaded.

2.02 JOINTS FOR POLYVINYL CHLORIDE (PVC) PIPE

A. Rubber ring seal joints shall be made in accordance with the manufacturer's instructions and as indicated on the plans.
B. Solvent weld joints shall be made using P-70 primer as manufactured by "Weld-On" or approved equal and "Weld-On" 710 joint cement or approved equal.
C. All threaded joints shall be factory formed. Field threading of pipe or fittings will not be permitted. Threaded joint connections shall be made with virgin teflon tape, or approved equal.

2.03 VALVES AND VALVE BOXES

A. Gate valves, where required on the plans, shall be the same size as the main line and shall be as shown on plans or approved equal. Size and type of valve shall be as indicated on the plans.
B. Quick coupling valves shall be as manufactured by "Rainbird", brass or bronze one piece body designed for a working pressure of 125 psi and equipped with metal covers, or approved equal. Contractor shall provide the Engineer with three (3) for each quick coupler keys and double lug hose swivel ells. Type and model of valve shall be as indicated on the plans.
C. Remote control valves shall be as shown on plans, normally closed, diaphragm actuated, electrically operated from remote location by means of 18/24V, 50/60H, 7.5VA coil, with brass bleed plug for manual operation. Substitutions for irrigation controllers and/or remote control valves shall be at the sole option of the Engineer and shall require prior written consent. Remote control valve sizes shall be the same as the supply runs on which they are to be installed.
D. Valve boxes for gate valves and remote control valves in turf, shrub and ground cover areas shall be fiberglass reinforced plastic, color green, as manufactured by "Ametek", "Carson" or approved equal.
E. Gate Valves Box Covers to be factory marked "Irrigation Control Valve" and shall have a valve number permanently stenciled on it with white exterior paint.
F. Remote Control Valve Boxes shall be rectangular with a minimum dimension of 10-1/2" x 17-1/4" at the base. Cover to be factory marked "RCV" and shall have a station number permanently stenciled on it with

white exterior paint.

G. Valves shall be individually housed. Manifolding of valves in a single valve box shall not be permitted.

2.04 SPRINKLER HEADS

A. All bubblers and stationary shrub sprays on risers, pop-up spray heads and gear-driven stream rotors for ground cover, shrubs and turf shall be as manufactured by "Toro" or approved equal. Type and model of such heads shall be as indicated on the plans.

B. All pop-up spray heads and gear-driven stream rotors for ground cover, shrubs and turf shall be as manufactured by “Rainbird” or by "Hunter", or approved equal. Type and model of such heads shall be as indicated on the plans.

2.05 IRRIGATION LINE INSTALLATION

A. Controllers for irrigation systems shall be solid state type controllers as manufactured by either Rainbird or Hunter or as shown. Controller installations shall consist of models to provide the required number of control valve stations to a maximum of twenty-four (24) stations per controller installation:

B. Substitution for irrigation controllers on an "or equal" basis shall be at the sole option of, and shall require the prior written consent from the Engineer.

C. Remote final strength shall be verified by the contractor in presence of the project inspector prior to final installation to determine the need of a high gain antenna assembly.

D. Irrigation controllers shall be mounted as specified in the Detail Drawings.

E. Controllers shall be 120V from a metered power supply, unless solar or battery operated systems are specified.

F. All electrical wires and cables, shall be placed in conduits (1” minimum diameter).

G. Controller enclosures shall be furnished with acceptable keyed locking mechanisms and furnished with keys.

2.06 BACKFLOW PREVENTION DEVICE

A. Backflow prevention devices shall be as required by Section 1003 of the Uniform Plumbing Code, and as approved by the City/County Public Health Department. Model and details of such devices shall be as indicated on the plans.

2.07 CONTROL VALVE CIRCUITS

A. Wire for valve control circuits shall be UL-approved for direct burial in ground, size #14-l. Common ground wire shall have white insulating jacket. Control wire shall have jacket of color other than white and the jacket color for any circuit shall be continuous between controller and valve. A circuit color code schedule shall be posted inside each controller enclosure.
B. Splices shall be made with #2006-S "Buchanon" splice caps and 3M #3576 "Scotchloc" seal packs or approved equal.

2.08 THRUST BLOCKS FOR RUBBER RING SEAL JOINTS

A. Thrust blocks shall be provided where necessary to resist pressure on rubber ring seal joints. Concrete for thrust blocking shall conform to the requirements of Section 02550 of these specifications.

2.09 PIPE COVER MATERIAL

A. Shall be in conformance to Section 02202, Trenching and Backfill, of these Specifications.

PART 3 -EXECUTION

3.01 TRENCHING, BACKFILLING AND COMPACTION

A. Shall be in conformance to Section 02202, Trenching and Backfill, of these Specifications.

3.02 IRRIGATION LINE INSTALLATION

A. Pipe, valves, fittings, and appurtenances shall be installed as accurately as possible in accordance with the locations shown on the plans. All polyvinyl chloride (PVC) pipe shall be installed with identification markings facing upward, visible from the top of the trench. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly. Where pipes pass through sleeves, provide removable non-decaying plug at ends to prevent entrance of earth. No irrigation lines shall be constructed before subgrade for roadway and median areas have been satisfactorily completed.
B. Depth of cover for pressure mains shall be twenty-four (24) inches below subgrade in areas to be paved and in landscape areas. Depth of cover

for non-pressure lines shall be eighteen (18) inches below sub-grade in areas to be paved, eighteen (18) inches below subgrade for topsoil for mainlines and twelve (12) inches below subgrade for topsoil for lateral lines in landscape areas.

C. Pipe, valves and fittings shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. All polyvinylchloride (PVC) pipe shall be stored carefully, and protected from prolonged sunlight. Broken or damaged pipe or appurtenances will be rejected and shall be replaced.

D. Irrigation lines shall be installed as accurately as possible in accordance with the locations shown on the plans. The plans are diagrammatic only, and where irrigation lines on the plans are shown under paved areas but running parallel and adjacent to planted areas, the intent is to install the irrigation lines in the planted area. Irrigation lines shall have a minimum horizontal clearance of four (4) inches from each other, and a minimum horizontal clearance of twelve (12) inches from other underground lines (this requirement does not apply to any lines crossing at angles from 45 to 90 degrees with each other). A minimum of two (2) inches vertical clearance shall be maintained between lines which cross between these angles. No irrigation line shall be installed parallel to and directly over another line. Intermediate high spot along the irrigation line shall not be allowed.

E. All pipes shall be assembled free from dirt, shall be reamed and all burrs shall be removed. When pipe laying is not in progress, all open pipe ends shall be closed with watertight plugs in a manner satisfactory to the Engineer. Before installation of irrigation lines, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.

F. After the final positioning, the pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as are required to hold the pipe section in place. After joints are completed, the backfill material shall be redistributed and compacted as herein required.

G. At the end of each day and when work is not in progress, the open ends of pipe installed in the line shall be closed with watertight plugs, and openings for valves and other appurtenances shall be suitably covered.

H. Concrete thrust blocks of the form and dimensions shown or noted on the plans shall be provided as indicated on the plans. Form thrust blocks in such a manner to prevent any concrete from coming in contact with the pipe. Thrust blocks shall be constructed to completely fill the void between solid soil and the fitting, and shall be installed in strict conformance with the applicable details shown or noted on the plans.

3.03 JOINT AND FITTING INSTALLATION

A. Rubber Ring Seal Joints
   1. Use factory made male ends or prepared field cut male end joints to exact specifications of factory made ends. Join lengths of pipe by means of integrally formed bell end on pipe using rubber ring seal. Carefully clean bell or coupling and insert rubber ring without lubricant. Position ring carefully according to manufacturer's instructions.
   2. Lubricate male end according to manufacturer's instructions and insert male end to specified depth. Use hands only when inserting PVC pipe.
   3. Thrust blocks shall be provided where necessary to resist system pressure on joints or fittings made with rubber ring seal joint pipe in accordance with the details shown on the plans.

B. Solvent Weld Joints Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe of dirt, dust and moisture. Dry-insert pipe into fitting to check for proper sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket. Coat the inside socket surface of the fitting and the external surface of the male end of the pipe with 711 primer manufactured by "Weld-On" or approved equal. Then, without delay, apply "Weld-On" 710 joint cement or approved equal liberally to the inside of the socket. At this time, apply a second coat of cement to the pipe end. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. The fitting shall be properly aligned without strain. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

C. Threaded Joints
   1. Field threading of plastic pipe or fittings is not permitted. Only factory formed threads and factory fabricated nipples or risers shall be permitted.
   2. When assembling threaded plastic joints, take up joint no more than one full turn beyond hand tight.
   3. Threaded joint connections shall be made up with virgin teflon tape, or approved equal.

3.04 VALVE AND VALVE BOX INSTALLATION

A. Valve boxes shall be grouped and located in shrub and ground cover areas wherever possible. Valves shall be installed no farther than twelve (12) inches from the main line and no closer than twelve (12) inches

from walk edges, buildings and walls.

B. Thoroughly flush main line before installation. Valves shall be installed as indicated on the details shown on the plans.
C. All control valves shall be three (3) inches minimum and eight (8) inches maximum below finish grade to the top of the flow control stem.
D. Quick coupling valves shall be located as called for on the plans and installed as indicated on the details shown on the plans.
E. Valve boxes shall be set flush with finish grade in lawn areas and one and one-half (1-1/2) inches above grade in shrub areas.

3.05 SPRINKLER HEAD INSTALLATION

A. Lawn heads shall be located with a minimum of one (1) inch, a maximum of two (2) inches, clear from adjacent paving or headers, and flush with them where a potential hazard may occur. Other lawn heads shall be installed as indicated on the details shown on the plans.
B. Pop-up heads of approved design shall be installed at edges of landscaped areas adjoining paved areas as indicated on the details shown on the plans. Interior shrub heads shall be either pop-up heads set level with finish grade or fixed heads set six (6) inches above finish grade.
C. Individual heads shall be adjusted as required to obtain uniform coverage without overthrow onto buildings, paving, main walks, or other structures.
D. Each section of lateral pipe shall be thoroughly flushed out before the sprinkler heads are attached.
E. Sprinkler heads shall be located and installed as shown on the plans.

3.06 IRRIGATION CONTROLLER INSTALLATION

A. Controller enclosures shall be located, and irrigation controllers and enclosures shall be installed, as shown on the plans. The sprinkler controller chart shall be a photostatic reproduction of the sprinkler or irrigation plan, provided and installed by the Contractor. It shall be laminated permanently in plastic and securely attached to the inside lid of the controller cabinet and shall correctly relate each section to its respective system.

3.07 CONTROL WIRE INSTALLATION

A. Connection of control lines to controller shall be in sequential arrangement according to assigned identification number of valve. Connections shall be made by crimping bare wires with brass connectors and sealing with epoxy resin sealer packs. Control lines shall

be labeled at the controller with permanent non-fading labels indicating identification number of valve controlled.

B. All control wiring shall be laid to minimum depth of eighteen (18) inches in common trenches with mainline piping wherever possible. Where control lines do not parallel mains, wires shall be strapped at intervals of at least ten (10) feet to the underside of two by four redwood boards.

C. Where control lines pass under paving, they shall pass through Schedule 40 PVC conduit sleeves. Where control wires pass through sleeves, Contractor shall provide removable non-decaying plug at ends of the sleeve to prevent entrance of earth.

D. Contractor shall loop a minimum of three (3) feet of extra wire in each valve box; both control wire and ground wire. All splices shall be made at a valve box only.

3.08 ELECTRICAL SERVICE INSTALLATION

A. Make all electrical connections to 120 Volt service at each controller location. Install a disconnect switch inside the pedestal of the controller cabinet. All electrical work and materials shall comply with these specifications and any further requirements of the permit issued for the electrical service connection by the serving utility.

3.09 TESTING

A. Hydrostatic and leakage tests shall be made only after the trenches have been backfilled sufficiently to hold the pipe firmly in position with no fittings being backfilled.

B. All welded plastic pipe joints shall have cured for at least 24 hours. Provide all water necessary for filling and flushing at no additional expense to the Contract.

C. Pressure irrigation mains shall be subjected to a hydrostatic test of 125 psi. Each section being tested shall be slowly filled with water, care being taken to expel all air from the pipe by such means as are necessary. The pipes must be flushed before testing to remove any foreign material. The test pressure shall be applied for not less than four (4) hours. Any leakage discovered in consequence of the pressure test shall be corrected and the test shall be repeated until satisfactory results are obtained. Any defective pipe, fittings, valves, or joints shall be repaired or replaced.

D. Contractor shall provide water as necessary for hydrostatic testing.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The establishment of a complete and uniform lawn including fine grading, sodding, and/or hydromulching.

1.03 QUALIFICATIONS

A. Lawn work to be performed by a single firm specializing in commercial landscape work with a minimum of five (5) years' experience on similar type projects. Owner to review qualifications and approve subcontractor prior to commencing work.

1.02 SUBMITTALS

A. Submittals shall be formatted in a three-ring binder (10 copies) with tabs identifying each section. Required submittal information for this section shall be included with the overall landscape submittal and shall be designated 'Section-20-Lawns/Fertilizer'. The following submittals are required for this section:

1. Product Data: Manufacturer's specifications and application instructions for fertilizer.

2. Certificates: Inspection certificate from Texas Department of Agriculture indicating sod has been found free of diseases, insects and larvae.

3. Certificates: Breakdown of seed types, percentages, and mixture composition.

4. Sod Delivery Tickets: One per truckload indicating sod species, nursery certification, date and time of cutting.

1.03 DELIVERY, STORAGE AND HANDLING

A. Sod Delivery: Have sod delivered within twenty-four hours of cutting. Stack sod with roots to roots, protected from exposure to elements during shipment.

B. Storage: Lay sod as soon a practicable after delivery. If installation is delayed more than four hours, store sod under shade and keep constantly moist. Sod must be laid within forty-eight hours of cutting. Do not pile more than two foot depth of sod. Do not tear, stretch or drop sod. Do not allow soil to break free of turf roots.

1.04 PROJECT CONDITIONS

A. Utility Construction. Do not lay sod or begin hydro-mulching until all underlying utility work is complete, trenches backfilled, compacted and graded, and topsoil place and fine grading.

1.05 MAINTENANCE/WARRANTY

A. Maintenance Service: Maintain the work of this Section until the Date of Substantial Completion and ninety (90) days thereafter or until a complete and uniform lawn has been established and final acceptance has been approved by Owner or Engineer.

1. Establish hydro-mulched or sodded lawns per planting plans. Reapply hydro-mulch or re-sod as necessary until full and uniform coverage is obtained.
2. Mow lawns to maintain height of grass at 2 inches or as directed by Owner or Engineer
3. Tim/edge all lawn areas adjacent to watering basins, pavements, driveways, walls, structures, curbs, planting beds, edges and island.
4. Provide weed, insect and disease control to maintain health of grass.
5. Fertilize with commercial grade lawn fertilizer until complete and uniform coverage is obtained.
6. Irrigation:
    a) If the irrigation system is operating, program and monitor the system to provide adequate water for grass.
    b) If the irrigation system is not operating, hand water grass.

B. Warranty: Warranty shall cover all lawn grasses for a period of three months from the date of substantial completion or until final acceptance by Owner. Final acceptance will not be approved until full and uniform lawns are completely established.

C. Maintenance Records: Contractor must provide Owner copies of all maintenance records including dates maintenance occurred, type of maintenance carried out, crew time on site and any issues such as problems with irrigation, etc.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sod: (See schedule for type). Provide premium #1 certified sod grown in a sod nursery on sandy soil, at least 1 yr. old with a heavy top and a strong, well-knit root system, and not more than five percent weeds or foreign grasses.

B. Hydro-mulch mixture: (See schedule for type). Lawn seed mixture shall be shall be fresh, clean new, crop seed. Hydromulch mixture shall be composed of both hulled and unhulled seed with an appropriate percentage of Rye according to season of planting. The Contractor shall furnish the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety for approval prior to beginning work. Any hydro-mulching applied before Engineers approval of the exact mixture will be subject to rejection and shall be re-done with approved mixture.

C. Fertilizer: 12-4-8 (N-P-K), formulated for slow-release Nitrogen.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which this work is to be performed. Have the installer notify the Contractor in writing, with a copy to the Engineer, if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Beginning of work indicates acceptance of the site as satisfactory by the installer.

3.02 PREPARATION

A. Site Preparation: Contractors must visit and review site prior to bidding. Compacted soils and sub-soils from construction activities must be ripped and tilled until a loose, friable and free-draining condition is met. All existing weeds, grass, stabilized sub-base material, rubble, excavated soil and other material shall be removed from the site and disposed of by the contractor prior to starting any new landscape work. Soil conditions around entire site must be approved by the Engineer prior to rough and finished grading operations. Contractor shall not install any fill or topsoil in landscape areas prior to site condition approval by the Engineer.

3.03 INSTALLATION- HYDROMULCH/SEED

A. All exterior ground within the limit of contract, except surfaces occupied by structures and paving, except areas indicated to be undisturbed, shall be seeded, hydro-mulched or planted as shown on drawings. Furnish topsoil as required, finish grading, prepare seed bed, seed, hydro-mulch and maintain areas as indicated on the drawings.

B. Lawn Area Preparations - Grade areas to finish grades, filling as needed or removing surplus material. Float all lawn areas to a smooth, uniform grade as indicated on Civil Engineer's grading plans. All lawn areas shall slope to drain away from structures, sidewalks, driveways and planting beds. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins/drain inlets, elevational steps or structures) and elevations shown on plans. Contractor to ensure proper drainage away from all structures. Adjust grades as necessary to direct water away from structures and planting beds. Report any discrepancies on all drainage issues in writing to the Engineer, and Owner or Owner's Representative.

C. Roll, scarify, rake and level as necessary to obtain true, even lawn surfaces. All finish grades shall meet approval of the Engineer before seeding/hydro-mulching operations. Loosen soil to a depth of three inches (3") in lawn areas by approved method of scarification and grade to remove edges and depressions. Remove stones or foreign matter over one half inch (1/2") in diameter from the top three inches (3") of soil

Float lawn areas to finish grades.

D. Lawn areas should be permitted to settle or should be firmed by rolling before seeding/hydromulching.

E. Seeding/hydro-mulching shall not be performed in windy weather.

F. Lawn areas shall be seeded by hydro-mulching evenly with an approved mechanical hydro-mulcher at the rate of a minimum of three (3) pounds per 1,000 square feet. In areas inaccessible to hydro-mulching equipment, the seeded ground shall be lightly raked with flexible rates and rolled with a water ballast roller. After rolling, seeded areas are to be lightly mulched with wheat straw or approved material.

G. Water seeded/hydro-mulched areas daily or as necessary to keep ground and hydro-mulch moist. Do not excessively water so as to cause erosion or ponding. Continue this watering regime until full germination. After germination period water lawn areas only as required to maintain health and vigor of grass growth. The surface layer of soil for seeded/hydromulched areas must be kept moist during the germination period. After first cutting, water as specified above.

H. Make daily inspections to determine the moisture content of the soil and adjust the watering schedule established by the irrigation system installer to fit conditions.

I. After grass growth has started, all areas or parts of areas, which fail to show a uniform stand of grass for any reason whatsoever shall be reseeded/hydro-mulched in accordance with the plans and as specified herein. Such areas and parts of areas shall be reseeded/hydro-mulched or sodded repeatedly until all areas are covered with a full and uniform stand of grass at no additional cost to the Owner.

J. Watering shall be done in such a manner and as frequently as is deemed necessary by the contractor or Owner to assure continued growth of healthy grass. All areas of the site shall be watered in such a way as to prevent erosion due to excessive

quantities applied over small areas and to avoid damage to the finished surface due to the watering equipment.

K. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor. The Contractor shall, however, furnish his own portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the lawn areas in an approved manner.

L. Mowing of the seeded, hydromulched or sodded areas shall be initiated when the grass has attained a height of three to four inches (3" to 4"). For subsequent mowing Bermuda grass shall be maintained at a height of 2" and St. Augustine grass shall be maintained at a height of 3". Not more than one third (1/3) of the grass leaf shall be removed at any cutting and cutting shall not occur more than seven (7) days apart.

M. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by Owner.

N. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by Owner.

O. Protect seeded/hydromulched areas against trespassing while the grass is germinating and growing-in. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout, settlement or other causes shall be repaired by the Contractor at their expense.

P. Remove all fences, signs, barriers or other temporary protective devices after final acceptance.

3.04 INSTALLATION-SOD

A. Sod shall be installed to all areas as indicated on plans.

B. Sod Bed Preparation - Grade areas to finish grade, filling as needed or removing surplus dirt, stone, debris, etc. and floating areas to a smooth, uniform grade as indicated on grading plans. All lawn areas are to slope to drain.

C. Sod shall be cut and laid on site the same day. Only healthy vigorous growing sod is to be laid.

D. Always lay sod across slope and tightly together so as to make a solid area.

E. Roll or firmly but lightly tamp with suitable wooded or metal tamper all new sod sufficiently to set or press sod into underlying soil.

F. Contractor to fill all gaps or seams in the sodded areas using clean sand.

G. After sodding has been completed, clean up and thoroughly water in newly sodded areas.

3.05 FERTILIZING- GRASS

A. Grass or sodded areas shall have fertilizer applied in two (2) applications with a thorough watering immediately following application. The first application shall be one (1) week before the hydro-seeding using a Starter Fertilizer 20-27-5 (N-P- K) at a rate of 3.5 lbs per 1,000 square feet and harrowed into the top two inches (2") of seedbed. The second application shall be done after grow-in using a Turf Builder fertilizer 12-4-8 (N-P-K) at the rate of 5 pounds per 1,000 square feet.

3.06 CLEANUP AND PROTECTION

A. Remove debris from landscaped areas daily and sweep clean adjacent pavements, if soiled by landscape activities.

B. Protect lawns from damage, theft or vandalism until final acceptance.

END OF SECTION